

# The impact of vertical relations in explaining the division of gains in mergers - European evidence

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**Abstract**

Vertical mergers remain relatively little studied topic in corporate finance. In this thesis I use input-output tables to identify vertical mergers and measure the degree of vertical dependence between the acquirer and the target in European mergers in the years 1990 to 2012. Using this information I study if the division of euro denominated gains in vertical mergers is influenced by the degree of vertical dependence between the target and the acquirer. Furthermore, I present data on the proportions of different merger types in Europe and demonstrate that vertical mergers are more common than suggested by traditional methods of identifying vertical mergers.

Although I do not find conclusive evidence that vertical dependence between the acquirer and target influence the division of gains, I find clues suggesting this, however, could be the case and would warrant further research.

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**Keywords** M&A, mergers, division of gains, vertical relations, input-output analysis, I/O methodology, Europe, econometrics, commodities

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### **Tiivistelmä**

Vertikaaliset fuusiot ovat verrattain vähän tutkittu aihe yritysjärjestelyissä. Tässä tutkielmassa käytän ns. input-output taulukoita tunnistaakseni vertikaalisia yrityskauppoja ja mitatakseni kaupan osapuolten keskinäistä riippuvuutta toisistaan hyödykemarkkinoilla. Tutkimusaineistoni koostuu vuosien 1990 ja 2012 välisenä aikana Euroopassa julkistetuista yrityskaupoista. Käyttäen hyväksi keräämääni tietoa yritysten julkistuksen yhteydessä syntyneestä pörssikurssien arvonnoususta/laskusta ja tietoa yritysten keskinäisestä riippuvuudesta hyödykemarkkinoilla arvioidakseni, vaikuttavatko yritysten vertikaaliset suhteet osapuolten väliseen neuvotteluasemaan vertikaalisissa yrityskaupoissa. Lisäksi esitän tietoa eri fuusiotyyppien yleisyydestä Euroopassa ja osoitan, että vertikaaliset fuusiot ovat yleisempiä kuin perinteiset arviointimenetelmät antavat ymmärtää.

Vaikka en löydäkään selkeää näyttöä vertikaalisuhteiden vaikutuksesta osapuolten neuvotteluasemaan tulokseni vihjaavat, että asiaa kannattaa tutkia lisää tulevaisuudessa laajemmalla aineistolla.

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**Avainsanat** yrityskauppa, fuusio, arvonnousun jakautuminen, vertikaaliset yrityssuhteet, input-output taulukot, Eurooppa, ekonometria, hyödykkeet

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# 1 INTRODUCTION

## 1.1 WHY MERGERS MATTER?

Research on Mergers and Acquisitions (M&A) has been one of the single biggest and diverse fields of study in corporate finance for decades – and for a reason. Mergers and acquisitions directly influence hundreds of thousands of people every year and restructure entities worth of billions of euros in value.

Vertical mergers have received relatively little attention in the empirical research compared to horizontal and conglomerate mergers. There are two reasons for this relative lack of interest. On the one hand the public interest has traditionally been on large horizontal mergers because their implications are more visible to the consumers. On the other hand vertical mergers tend to be more invisible to the public. If a car manufacturer acquirer's one of its suppliers consumers are unlikely to notice where as if a multinational bank takes over a local bank, often it is virtually impossible not to notice. However, there is another, more practical, reason for seeming lack of interest in empirical research in vertical mergers: the accurate classification of mergers has been and still is difficult.

Traditionally identifying a merger's type has relied on SIC or NAICS codes but these methods have proven unreliable as measure of vertical integration (Fan, Goyal 2006). This is because both SIC and NAICS measure the closeness of production process or output rather than the material flows between the companies. Consequently, this lack of both accessible and reliable merger type data has made it difficult to test already formulated vertical integration theories and their implications. In the few empirical studies conducted the researchers have had to rely on manual inspection<sup>1</sup> of each company or industry to determine if a vertical relationship exists or could exist. This is often unfeasible if data sets include thousands of companies and extend across decades. Furthermore, inspecting actual trading patterns of individual companies is limiting if the potential for trade is of interest. This is especially true if the industry is not very concentrated and the number of potential trading partners is large. Using commodity flow based input-output methodology can overcome some of these challenges. It works by tracking the aggregate commodity and intermediate product flows as

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<sup>1</sup> For example, Fee and Thomas (2004) identify vertical relations manually based on actual trading relations.

they move through the economy. This makes it possible to track and, if necessary, model quite complex vertical relationship networks.

## **1.2 RESEARCH PROBLEM**

Merger value creation has been extensively studied for decades. However, the questions regarding division of that value added between the target and the acquirer and the determinants of the division of gains are much less studied. Conventional wisdom and some previous studies propagate the notion that it is the target that captures the bulk of the merger gains. However, this view is inadequate as in most cases it is based on studies that only compare the average cumulative abnormal percentage returns of the acquirers to the corresponding average of the targets. It can be argued that because a typical acquirer is considerably larger than a typical target, using percentage returns yields misleading results. Furthermore, very little focus has been given to other potential causes for division of gains other than acquirer vs. target. Common sense suggests that factors such as relative competitive position, size difference and trade relations could plausibly be factors influencing bargaining power of the players. This thesis seeks to explore how product market relations affect the division of gains in vertical mergers. Instead of measuring merger gains based on cumulative abnormal percentage returns I measure the total gains in dollar terms.

## **1.3 DATA AND METHODOLOGY**

In this thesis I study 798 mergers, acquisitions and tender offers across 17 European countries between 1990 and 2012. First I classify these mergers as backward, forward, horizontal or conglomerate mergers using NAICS codes and vertical relationships variables calculated using input-output tables. Then using standard event study methodology I calculate the cumulative abnormal returns (CAR) in a three-day window surrounding the merger announcement date and use it to calculate cumulative abnormal euro returns (\$CAR) which in turn is used to construct a measure of the relative gain between the acquirer and the target ( $\Delta\$CAR$ ). This variable is then used as the dependent variable in a regression where relative supplier importance (RSI) and relative buyer importance (RBI) are used as main explanatory variables of interest. RSI and RBI are constructed from the information provided by the Input-Output tables and they proxy the vertical dependence of the two companies on each other.

## **1.4 MOST SIGNIFICANT FINDINGS**

Contrary to expectations I fail to find conclusive evidence in support of the notion that product market relations affect the division of merger gains. However, as my sample size is



considerably smaller than used in studies before there is plausible chance that failure to find significant results is due to insufficient sample size. The fact that significance of my coefficients are higher in same subsamples where previous studies find significant results corroborates with this idea.

Furthermore, I find that the common notion that target nearly always captures lion's share of the common gains is false. In approximately 40% of the mergers the acquirers capture greater share of the dollar gains and in the subsample where both companies have positive returns, this figure is 60%. Finally I find that vertical mergers are more prevalent than suggested by methodologies identifying vertical mergers based on SIC or NAICS codes. Horizontal and vertical mergers make up nearly 90% of the merger in the sample. Using NAICS based approach would have not revealed vertical relation in 40% of the cases.

## **1.5 CONTRIBUTION**

This thesis contributes to the literature on division of gains in vertical mergers and acquisitions – an area relatively little studied. Following the framework of Ahern (2012) the focus of the study is in the division of euro measured gains within the European vertical mergers during the past two decades. To my knowledge no such attempt has been made using European data. Furthermore, my work on classifying European mergers based on input-output (I/O) tables and NAICS codes is, as far as I know, unique. Not only I assess the fractions of different types of mergers but I also estimate how much better the I/O approach is than the traditional SIC/NAICS approach.

## **1.6 STRUCTURE OF THE STUDY**

The organization of this thesis is as follows: in the second chapter I go briefly through the key literature in the M&A research in general and my topic in particular. In the third chapter I introduce the research questions of this study and make the connection between the literacy review and the research objectives. In the fourth chapter I present in great detail the data and methodology used in this study and go through the methodological choices that I had to make. In the fifth chapter I present the main findings and analyze the results of the regressions. In the sixth and final chapter is the summary of the study and its main findings.

## 2 LITERATURE REVIEW

This section presents the literature relevant to this thesis. It has two distinct purposes which are also reflected in the structure of this review. Firstly, it is intended to provide an overview over the broad branch of finance research that focuses on mergers and acquisitions; its key questions and findings as well as the key differences of opinion. Secondly, this review seeks to provide the methodological and empirical background for understanding the execution of the study and interpretation of the results. It will also help the reader to understand the challenges and limitations imposed by the methodological choices.

The sections in this chapter are organized as follows. The first section gives an overall view of the various aspects of corporate finance research in mergers and acquisitions (M&A). It is followed by sections on merger classification, merger theories and finally empirical studies on gains in mergers and division of those gains.

### 2.1 GENERAL OVERVIEW OF THE MERGERS AND ACQUISITION RESEARCH

Mergers and acquisitions<sup>2</sup> research is the single most important and widely studied topic in the field of Corporate Finance – and for a good reason. M&As represent the single largest monetary transaction of any corporation, often involving major restructuring of one or both of the parties adding fair amount of uncertainty to the shareholders and managers alike. Besides the shareholders and the management, there is always a wider impact to the society at large in terms of employment, competition and strategic ownership. For all these reasons governments have a special interest in monitoring and regulating merger activity. Considering all this, it is only natural that tremendous interest has been and continues to surround the merger activity not only in finance research but also in organizational studies and various related fields.

Due to the immense volume of research over the past four decades it is impossible to go through even all of the most important articles. Despite this I attempt to give a broad overview of the most relevant issues in the field. I start this review by classifying the questions or research topics in the literature in three broad categories based on the main research problem or goal tackled in each category. It is worth noticing that in practice many studies could be arguably placed into more than one category and that most studies have some

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<sup>2</sup> From now on I shall use words "mergers" and "M&As" as synonyms for "mergers and acquisitions" unless otherwise specified.

elements of all the categories. The classification system does not follow any previous system and merely reflects my way of structuring the literature. The categories are listed below and they are explained briefly in the following paragraphs.

- 1) Descriptive questions
- 2) Value creation questions
- 3) Explanatory questions

In the following sections I will briefly go through each of these categories and explain with examples what do they in real terms mean. Then at the end of section 2.1 I will also explain some of the problems encountered by the researcher when studying mergers.

### 2.1.1 DESCRIPTIVE QUESTIONS

Studies classified as “Descriptive” are best described as investigating what kind of properties the mergers have. Questions like “are some industries more prone to mergers than others (Mitchell, Mulherin 1996), “are certain types of mergers more common than others” and “do mergers cluster in time” (Andrade, Mitchell & Stafford 2001) are examples of descriptive research questions. Due to the fairly straightforward nature of descriptive studies, most of them were conducted early on and in their pure form represent fairly small fraction of the contemporary research. However, it is worth pointing out that most of the current finance studies all pose and answer some kind of descriptive questions besides their main research problem. This way the “descriptive” literature is constantly being updated.

### 2.1.2 VALUE CREATION QUESTIONS

Value creation research focuses on investigating questions regarding the value creation in merger activity. The first question that was studied was obviously “do mergers create value”. Although at first the question sounds fairly straightforward, it is actually fairly complicated one. The most typical approach is to use stock reaction event study – either short-term or long-term and try to measure value creation based on it. Neither of the approaches is without problems and in the subsequent years a number of studies have used various accounting and other real variable based measures in trying to answer the question<sup>3</sup>.

Over time, majority of the empirical studies found that based on short event window equal-weighted stock market response indicated that mergers do create value. As the evidence for

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<sup>3</sup> For example, see Healy et al. (1992)

increased shareholder value started appearing the focus shifted on investigating does the observed gains represent true value-added or are they merely a result of redistribution of wealth from other stakeholders such as the bondholders (Asquith, Kim 1982), customers (Weston, Mitchell & Mulherin 2004, Fee, Thomas 2004) or the government (Neumark, Sharpe 1996). Consensus on the issue presently is that observed gains do represent genuine value addition, not redistribution.

When thinking of value creation, from business point of view the most important question is, of course, what factors add value to mergers? Why some mergers succeed while others fail spectacularly? Can a successful merger be detected ex-ante? These all are questions that are not yet satisfactorily answered. A number of different studies have identified factors that are associated with increased or decreased returns to either acquirer or the target but general theory of merger is still missing.

Besides questions of value creation there is the derived question of how is the gain divided. Common wisdom suggests that it is the target who gains the most; after all, there is a very compelling common sense argument for it: the seller is nearly always better informed of its value and no rational shareholder is willing to sell their stake below the prevailing market price. Furthermore, the mere fact that another company is seeking to buy your company reveals that they deem that going market price of the target is attractive compared to their private valuation of the target company. Thus it is very unlikely for a target to lose out when merger is proposed. Acquirer on the other hand bears downside risk as he is buying something of which value he cannot accurately know before buying it. Division of gains research focuses on finding out how merger gains are divided between various stakeholders, typically the acquirer and the target, and what reasons affect the division of value added. The thesis you are reading falls into this category of research.

### **2.1.3 EXPLANATORY RESEARCH**

Explanatory research seeks to answer the question why do mergers occur in the first place and what motives do companies have when they choose or choose not to merge. This is one of the most researched questions in the field and consequently a number of theories and hypothesis have been put forward and tested. Most widely discussed theories can be grouped into 3 categories: 1) value creating theories, 2) value neutral theories and 3) value destroying theories. These merger theories and how they could impact the division of gains will be discussed later in Section 2.3.

#### 2.1.4 METHODOLOGICAL ISSUES IN MERGER STUDIES

Finance is a field with strong empirical foundations. However, unlike physics or medicine finance is a social science and with that comes certain degree of uncontrollability. Research cannot be conducted in isolation but is intertwined with the world surrounding us. The quality of data is often a big question and availability of relevant data even more. Often research has to be conducted with less-than-optimal data. Before we examine the different merger theories and their supporting evidence, it is worthwhile to give a little consideration for various methodological issues that make corporate finance research challenging.

Most merger studies use event study methodology<sup>4</sup>. The core assumption of these studies is that a merger announcement should yield a stock market reaction on one or more of the stakeholders be it the target, acquirer, their customer, competitor or supplier. Implicitly this assumes that markets are at least semi-strongly efficient meaning that market participants immediately and correctly incorporate all new and relevant data to their valuation of the stock and this way the market participants' future expectations are reflected in the price of the stock at announcement. Different hypotheses have different predictions regarding the direction and magnitude of the announcement reaction. By studying the reaction in the stock or bond markets of different stakeholders we should be able to deduce something about the market-perceived motives of the mergers, assuming of course that the semi-strong form efficiency prevails in the markets. Although in principle simple, this is where the simplicity ends. In this study I assume that the stock markets are semi-strongly efficient meaning that any relevant new information coming to public knowledge causes a near-instant rational response to the stock market price of the companies.

The definition of a relevant stakeholder is not always so simple and neither is the choice of methodology. Obviously the shareholders of the merging companies are relevant stakeholders but how about the bondholders, the government or the customers of the companies? Numerous environmental organizations such as Green Peace have argued that environmental impacts should also be factored in when considering value increase. This is especially important if we seek to assess the overall financial impact of mergers to the society at large. Different studies have taken different stances. Most often only the stockholders of the merging companies are considered but there are studies that explicitly assess the impact to tax

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<sup>4</sup> See Section 4.3 for a more detailed explanation of the event study methodology.

authorities and bondholders. However, especially when addressing policy questions impact on employment and environment might be relevant view points as well.

Relatively small sounding methodological questions can also be of crucial importance. A choice as simple as the weighting of the observations can be crucial in deciding the conclusion of the entire study. For example, Moeller (2004) finds that choice of weighting the observations between dollar and equally weighted measure can affect the outcome of the study. They find that when observations are equally weighted, mergers generate significant positive total abnormal returns, however, the result is reversed if dollar weighted abnormal returns are used instead. This suggests that large mergers fail more often than smaller ones and that the losses of large mergers eat away the gains from small mergers. Despite this seeming conflict it is not possible to say that one way is right or wrong. Actually, both methods are correct but they merely answer a different question. If one uses percentage returns (with equal weighting), one is interested in the returns of a randomly chosen merger. This is a relevant question if the investor follows investment strategy of investing fixed amount of money into a merger (rather than fixed percentage). If one uses the dollar weighted returns, one is interested in the aggregate effects of the mergers.

Besides the choice of weighting, choice of benchmark index could also play a crucial role as suggested in a study by Dimson and Marsh (1986) who investigated the size effect in event study methodologies. They find that ignoring company size in choice of benchmark index can lead into serious distortions of results, especially with long event windows. The choice of time frame for the study is also relevant. The world changes and results can change with it. Trends or phenomena that were observed 20 years ago might no longer exist today. For example, proliferation of communications technology and computational capacity could plausibly have increased market efficiency. Studies testing market efficiency using data from the 1960s could have results quite different than those conducted with contemporary data. Degree of market efficiency in turn could also impact result of studies that make strong assumptions about degree of market efficiency.

Even though perfect experimental set up probably does not exist, different methods and choices, although imperfect, give new insights to problems studied. However, the challenges presented above mean that one needs to be careful when interpreting the results of any studies. Understanding limitations and possible biases introduced by different methods or samples is crucial when trying to generalize the results of a study. In this literacy review I

have tried to include sufficient information about the choice of methodology of the referenced study if it is unusual among similar studies or if the study is unique.

## **2.2 MERGER CLASSIFICATION**

To better understand the whole M&A research it is necessary to understand certain basic concepts. One of the most central concepts is the classification of mergers. There are number of different ways to do this, such as the acquirer's attitude (friendly vs. hostile), how merger is financed and paid (e.g. levered buy-out, stock swap, cash) and how the offer is made (tender vs. negotiation with the management). Each of these classifications have a number of interesting studies related to them but for the purposes of this thesis those mentioned above are not very relevant. The most relevant classification for my purposes is grouping based on the relatedness of economic activities of the merging companies.

In the following sections I am going to introduce the classification system for relatedness of economic activities I am using for this study. The characteristics of each of the different merger types are described in their own subsections. I am using modified Weston's (2004) classification scheme as a basis. Following the original scheme, mergers are classified into three distinct groups: 1) horizontal mergers, 2) vertical mergers and 3) conglomerate mergers. I differ slightly from Weston in exactly how mergers are classified into these groups. Differences are explained in the subsequent subsections as they arise. In the next subsection I am going to describe horizontal merger and relevant research on it. In the following subsections vertical and conglomerate mergers are discussed in similar manner.

### **2.2.1 HORIZONTAL MERGER**

In common finance jargon horizontal merger means a merger between companies of similar or identical offering and can be thus considered competitors in most cases. While Weston uses more specific criteria, for the purposes this study, I classify merger as horizontal if the merging companies operate and compete in similar business activities. For example two banks merging or two paper-mills merging would be classified as horizontal mergers. Weston (2004) places an additional requirement for the operating region; companies also need to be competing for a same geographical market to be classified as a horizontal merger. If the companies do not compete in a same market the merger is classified as a subtype of a conglomerate merger. While it is easy to see behind this logic, I will not use Weston's scheme due to missing information regarding geographic operations. I use SIC/NAICS codes to

identify horizontal mergers and this system or any other information source I use do not provide data about the prime operating markets.

### ***2.2.1.1 HORIZONTAL MERGER HYPOTHESES***

The stated reasons for horizontal mergers are usually economic in nature; economies of scale or scope, reduction of overcapacity, elimination of overlapping functions or other efficiency gains are often cited. However, critics and regulatory authorities have raised concerns that horizontal mergers are be driven by desire to increase market concentration of the industry leading to easier collusion among the industry. Since this collusion motive is usually illegal, it is rarely mentioned as a reason by the managers.

What is the reality then?<sup>5</sup> Why horizontal mergers happen? In the following subsections I will first discuss the efficiency hypothesis and then evidence supporting this view and then proceed to assess the evidence for collusion hypothesis and discuss a little bit merger regulation and its potential impact on the merger activity.

#### ***2.2.1.1.1 Efficiency hypothesis***

General efficiency hypothesis proposes that mergers create synergies that enhance the efficiency of the combined entity. In case of horizontal mergers such efficiencies could arise from economies of scale, reallocation of production within existing assets, elimination of overlapping functions and more efficient sourcing of raw materials (Ilzkovitz, Meiklejohn 2006). Horizontal mergers can also be used to broaden the product offering when products of the industry are differentiable or to enter new markets in case the acquirer lacks presence where the target has presence such as a different country or state (Weston, Mitchell & Mulherin 2004).

There is abundance of literature examining the profitability of mergers in general. A considerably smaller number focuses specifically on horizontal mergers, however. This is partially because investigating a particular type of efficiency using accounting or market data might not be very easy. For example, it is possible to examine if the profitability of the company has improved but considerably more difficult to say what can attribute for the improvement. A considerable number of studies on horizontal mergers approach the issue

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<sup>5</sup> Naturally there are other proposed merger motives such as the agency and hubris hypothesis. However, they are applicable to other types of mergers as well. They will be discussed in sections 2.3.2 and 2.3.3 respectively.



indirectly. Instead of looking for signs of efficiency they look for evidence of alternative causes such as increased market power as suggested by the collusion hypothesis. If there is an observed increase in profitability and it cannot be attributed to collusion then it is taken as evidence for increased efficiency due to economies of scale, technological transfer or any other non-collusive reason that might enhance the value of the company. Collusion hypothesis and studies on market power as source of merger gains in horizontal mergers are more thoroughly discussed in the following section and studies that provide support for the efficiency hypothesis are also listed there.

#### ***2.2.1.1.2 Collusion hypothesis***

Are horizontal mergers primarily driven by “legitimate” efficiency reasons or is the sweet talk about synergies just smoke and mirrors to cover collusion? A number of studies have addressed this question but results have been conflicting. The choice of relevant markets and methodology has decisive impact on the outcome. When measuring the market power on vis-à-vis customers using primarily announcement returns, no evidence of increased market power was found (Eckbo 1983, Stillman 1983, Fee, Thomas 2004, Shahrur 2005). However, the opposite conclusion was drawn when product prices were studied (Barton, Sherman 1984, Borenstein 1990, Prager, Hannan 1998).

It should be noted, however, that the studies which found evidence for collusion measured just the observed price changes in the relevant market and ignored other aspects. While observing real prices sounds more convincing measure of market power, in reality it is not without complications. Price is not the only variable that companies use when competing. It is possible that consumers are benefitting in higher quality of products or better service in spite of the price increase. The same could be true to opposite direction: lowered prices might mean lower quality of products or worse services. Furthermore, all of the studies listed above have focused on a single industry<sup>6</sup> and only on mere one or two companies within that industry which makes generalization difficult. Consequently, drawing strong conclusions from these studies on product prices should be avoided. My interpretation of the evidence is that horizontal mergers are primarily driven for efficiency reasons rather than seeking of market power in vis-à-vis customer market, although both motives along with others are likely to be present.

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<sup>6</sup> Prager focused on banking industry while Borenstein studied then recently de-regulated airline industry.

Although the evidence does not support the view that horizontal mergers are driven by desire to acquire market power in against the vis-à-vis customer, it is possible that companies may be driven by motives to gain market power relative to their suppliers and corporate customers. After all, the regulatory oversight for consumer market companies is likely to be tighter than companies having no consumer contact. If this was the case, there should be an adverse reaction to the stock prices of the suppliers and corporate customers of the merging companies. Two complementary studies have been conducted in the recent decade investigating this possibility.

Following the approach originally suggested by Eckbo (1983), Fee and Thomas (2004) examine the valuation impact at the announcement to the merging parties, corporate customers and suppliers and post-merger changes in their operating performance. They use actual stated customer-supplier relationships identified in FASB No. 14 statements and find evidence consistent with synergies and inconsistent with collusion. Merging companies experience significant positive stock market reaction while the reaction of customers and suppliers is insignificant. However, they do find evidence that market power does play some role in sources of gains as evident by temporary changes in operating performance measures and the number of supplier experiencing negative response to merger announcement. Similar results were found in a subsequent study by Shahrur (2005) which utilized Input-Output tables in identifying potential suppliers and customers. In addition Shahrur finds that horizontal mergers decrease market power of suppliers when supplier industry is highly concentrated.

As a conclusion to this section on horizontal mergers, it can be said that collusion or desire to create abusive market power has not the primary motivation for mergers in the past 30 years. For the regulatory authorities this is good news. However, it is impossible to say is this result due to regulatory oversight or some other reasons. In any case the recent concerns over the collusive mergers seem exaggerated. In the next section I will briefly discuss vertical mergers and research on them.

#### **2.2.1.2 HORIZONTAL MERGER REGULATION**

Horizontal mergers are the most significant type as they have the potential to collusion and reduce competition. For this reason, most merger related legislation is directed against horizontal mergers. Partially because of this and also because of relative easiness in detecting vertical relatedness, horizontal mergers have been the most widely studied type of merger.

Regulators use various tools in determining the market power of the merging companies and the market structure implications of the combined company. Herfindahl–Hirschman index (HH-index) and industry specific concentration ratios, and sometimes even proxy for Lerner index, are used to assess anti-competitive potential of a horizontal merger. For example concentration ratio of 8 largest firms would tell us the combined market share of the 8 largest firms within the 3, 4 or 5 digit NAICS code. However, the concentration ratio can give a misleading picture over the prevailing situation: a market with 8 firms commanding 80% market share each one having a 10% share is significantly different from market where the same 80% is divided so that one company has 70% and the rest share the remaining 10%. HH-index measures the market concentration after squaring the shares before summing giving largest companies even larger score and thus being able to differentiate in situations where concentration ratios fail.

For interested reader, Neven and Röller (2005) have written an excellent overview on contemporary merger control.

### 2.2.2 VERTICAL MERGER

When two or more companies that use the output(s) of the other(s) as their own input merge the transaction is classified as vertical merger. Vertical mergers are relatively little studied topic in the field despite their considerably large share of all mergers. Depending on exact definition and the underlying sample, vertical mergers constitute 30%–40% of all merger activity in the US and Europe<sup>7</sup> (Ahern 2012).

Reason for this seeming lack of interest in research is that the suitable data have been difficult to find and time consuming to process. The problem is basically how to identify a vertical merger or vertical relationship. The literature has so far used two basic approaches. First, the information can be collected by tracking real supply information from various sources such as company financial statements<sup>8</sup>, press releases and interviews. While this approach yields very accurate results regarding the true supply relations it is time consuming and prone to omissions. The other option is to rely on aggregate data on industry level supply relations.

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<sup>7</sup> This estimate is based on aforementioned study and the number of vertical mergers in the sample used for this study. The estimate should be considerate as indicative as the methods used are not directly comparable.

<sup>8</sup> In the US FASB No. 14 requires disclosure of customers and suppliers exceeding certain threshold level in company's financial statements.

While this approach is considerably more general and does not necessarily reflect true supply relationships between specific companies, there are compelling arguments for its quality as a good proxy for most applications. The positive side of this approach is the easy availability of data and smaller chance of omitting important suppliers and also including potential suppliers and customers into the data set.

Why do vertical mergers take place? The question is closely related to whole question of why do companies choose or choose not to integrate and it is primarily studied in the field of industrial organization. In the literature most often integration is seen as a development towards greater efficiency and/or profitability and more often than not, the proposed explanations reflect this view. This is probably because these reasons give intuitively more appealing explanation to decision to merge than agency or hubris based explanations. In this section I discuss motivations for companies to vertically integrate which in turn explains why companies may want to integrate vertically. Do notice that reasons applicable to other merger types, such as managerial hubris or agency motives, are discussed more thoroughly in the Sections 2.3.2 and 2.3.3 and are therefore left out of this section.

Value enhancing reasons for vertical integration can be broadly classified into 3 broad categories: 1) synergy and efficiency, 2) market failure and imperfection reduction and 3) market power. This categorization is my own and is briefly introduced in the following sections.

#### ***2.2.2.1 SYNERGY AND EFFICIENCY THEORIES OF VERTICAL INTEGRATION***

As in case of horizontal mergers, vertical integration raises prospect of direct operational efficiencies. Although the source of the efficiencies can be economies of scale, such as merging of sales offices or accounting unit, other synergy potential unique to vertical companies also exist. In this section I will briefly go through the most important of them as suggested by Neven and Röller (2005) and supplemented by my own examples.

##### ***2.2.2.1.1 Economies of scope***

Economies of scope are said to exist if the average unit cost drops as more than one product are produced together. This is especially true for services or product-service bundles. Elevator and escalator industries are a good example this. Nearly all elevator and escalator makers are vertically integrated. Not only they produce to product but also to sell and provide the maintenance service to them. Another example could be game console makers integrating into

making games for the consoles. For instance, Microsoft sells its X-box on reduced prices but recovers the loss in selling games to it.

#### ***2.2.2.1.2 Synergies of physical proximity and technology***

Synergies arising from proximity refer to synergies that are realized when close proximity of production facilities reduces costs. This is especially relevant in heavy bulk industries such as chemical and steel. For example, steel mill and foundries can enjoy significant cost savings if located at the same site due to reduced transportation, energy<sup>9</sup> and inventory costs. The same is true for many chemical industries where residual heat or waste products are used as input in a subsequent or other chemical processes. These synergies arise from the physical proximity of the production facilities but there are other kinds of synergies present part of which are introduced below.

#### ***2.2.2.1.3 Synergies in supply chain management, quality control and R&D***

Synergies in supply chain management, quality control and research and development can also be reason for vertical integration. Control of long segments of the supply chain enable companies to better manage their inventories and procurement. This does not only help to minimize the bullwhip effect<sup>10</sup> and unwanted oscillation in production but also same raw materials used in multiple stages of the production can be purchased at reduced prices. Careful planning can also reduce lead times throughout the supply chain. This can be a source of considerable competitive advantage in fast paced industries with relatively long lead times, such as fashion apparel. Merging of R&D departments of multiple stages of production not only save in simple equipment costs but also foster innovation and improve compatibility of inputs between various stages of production.

#### ***2.2.2.2 MARKET FAILURE AND IMPERFECTIONS THEORIES OF VERTICAL INTEGRATION***

In addition to synergies and efficiency explanations, vertical mergers could also be explained as a result of market failures and imperfections. An entirely new school of thought emerged in the 70s offering to explain vertical integration as a rational response to market and

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<sup>9</sup> If steel is delivered to the foundry while it is still molten or hot, foundry need not to use as much energy to re-melt the steel.

<sup>10</sup> Bullwhip effect arises when small unpredicted changes in demand in the lower parts of the supply chain cause proportionally much larger response in demand in the upper parts of the supply chain because each production stage wants to keep progressively larger safety stock.

institutional frictions that lower the output of the companies below their theoretical maximum. Beginning with Williamson (1971), in this framework integration is seen as a corrective organizational response to the market failures and the goal of integration is to restore the combined output closer to the level that would prevail in absence of the market failure. In this section I introduce two leading theories in the field: the transaction cost economics (TCE) and property rights theory (PRT).

#### ***2.2.2.2.1 From Ronald Coase to the transaction cost economics***

The first academic attempt to explain vertical mergers was by Ronald Coase (1937). Coase's focus was not vertical mergers but rather the boundaries of a firm and how contractual costs played role in defining those boundaries. In his landmark paper "The Nature of the Firm" (Coase 1937), he asked why firms exist in the first place as opposed to series of small players acting with each other through product markets. He went beyond the traditional economies of scale argument asking why most industries have multiple sized firms; if the economies of scale or scope favor larger units, why do we not observe just one or few companies producing everything. His conclusion was that companies face a number of internal and external transaction costs which determine the optimum size of the firm. The entrepreneur decides the optimal unit size by looking at the relative transaction costs inside and outside the company. When the total costs of contracting through markets exceed the total costs of producing internally, the company will choose to produce internally as opposed to sourcing externally.

Coase's work was carried on by next generation of researchers, such as Oliver E. Williamson and Benjamin Klein. They and others picked up where Coase had left and begun to identify institutional and structural factors that discouraged companies from operating in the spot market. This line of research has become to be known as the "Transaction Cost Economics" (TCE). Perhaps the best known work in TCE is Williamson's book "Markets and Hierarchies" (1975). What makes Markets and Hierarchies so special is not only that it is one of the first works in TCE but also because it draws from three different fields: microeconomics, organizational theory and contract law.

#### ***2.2.2.2.2 Transaction cost economics explained***

The central premise of TCE approach as outlined by Williamson (1971, 1973, 1981) is that the real world and real world market participants deviate from the idealized assumptions of perfectly competitive markets of microeconomics in several important ways. He identifies a set of human and transactional factors that complicates the trading in the spot markets and

which incentivize companies to integrate instead. The companies weight these expected costs against expected costs arising from producing the good internally such as increased planning complexity and managerial overloading. The company will then integrate to the extent when the total costs are minimized.

The classical micro-economic theory makes certain assumptions on free markets and states that those who are the most efficient at producing a good will end up producing the good whereas those who are less efficient at production will be eliminated as competition intensifies. This would suggest that companies will integrate vertically only if they possess a competitive advantage such as greater efficiency. However, very few markets are perfectly competitive in a way suggested by the theory. In reality various frictions and deviations are observed. Barriers to entry, such as government regulation or large initial investments to enter, cause some industries to have just a few producers. Railroads are a good example of this. Requiring not only huge initial investments to start operations but also are subject to extensive government safety regulation. For this reason there are usually only very few railroad companies operating in the same area.

Besides barriers to entry, product differentiability and high transport costs mean that even if the industry has large number of competing producers, individual producers can still command considerable pricing power due to differing requirements of different buyers. In an extreme case customized goods have very little to no value to any other market participant except the original customer. To continue the railroad example, imagine a mine in a remote area in Alaska with poor access to transport infrastructure. A railroad company could be persuaded into building an extension line to the mine and then the ore could be transported inexpensively via rail. Once the tracks are laid the railroad would serve only the mine as there are no other potential customers nearby.

The mine example above serves to demonstrate another problematic property of certain real world markets. In many industries recovering the initial investment takes years and during that time the company earns considerable quasi-rents<sup>11</sup>. In case of the railroad, once the tracks

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<sup>11</sup> Quasi-rent refers to the return on an asset that exceeds its opportunity cost in the short-term as a result of providing an incentive to make the investment viable in the long-term. For example, an initial investment to a relationship specific asset or a patent is an example of a quasi-rent. Economic rent in contrast refers to return that

are laid, the rail upkeep costs are fairly low and the railroad is expected to earn large quasi-rents over the useful life of the rail line to recover the initial investment. It is obvious that the railroad company will not invest if the mine chooses to switch to road transportation the next year or if the mine will be depleted after few years. However, under the classical economic theory both parties should be able to reach a mutually beneficial agreement if both stand to gain and negotiating a contract is not too costly.

Real world humans are very different from the idealized humans of the classical micro-economic theory. People are mostly reasonably rational but are hindered by memory and other cognitive limitations such as absence of unlimited computational capacity. In economics this observation is called “bounded rationality” and it has in many cases replaced the traditional hyper rationality assumption in economic theory. The practical implication of this is that contracting becomes suddenly much costlier as a large number of possible contingencies should be prepared for. In theory the participants could write and open contract which stipulates that contract will be renegotiated if circumstances change unexpectedly. Unfortunately real life is not as simple as besides bounded rationality people also tend to be opportunistic.

Opportunism refers to people’s tendency to try to seize personal gains through lack of honesty or “honor” in transactions. This can be either through use of asymmetric information to one’s advantage in negotiations or “unfairly”<sup>12</sup> taking advantage of circumstances at the time of execution or renegotiation of a contract. It is important to notice that an action needs not to be illegal to be considered opportunistic; it can be perfectly legal but is often perceived by others as unethical. In our railroad example the railroad, once built, becomes a sunk cost. The mine would have incentive to try to renegotiate the deal once the railroad has been built and try to extract part or all of the quasi-rent earned by the railroad. Or alternatively the railroad could try to profit from high commodity prices by trying to renegotiate the transport prices at a later date. In brief opportunism means that one cannot trust the opposite party to treat one fairly if possibility of taking advantage of one arises.

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exceeds assets opportunity cost also in the long-term. Royal monopolies during the age of mercantilism are an example of economic rents arising from political decision.

<sup>12</sup> Although fairness and unfairness are very subjective concepts, in this situation I define unfairness as behavior or information that would have prevented the signing of the contract had the other party had prior knowledge of the other’s behavior or information.



Bounded rationality and opportunism are what Williamson (1973) called “human factors”. They make making comprehensive contracts difficult and costly to write. However, they are not really a problem when operating in the spot market. If there are plenty of sellers and the product sold is homogenous even untrusting parties can engage in trade in the spot-market trusting that if the other party tries to take advantage of one, one could always find an alternative supplier. Combined with what Williamson called “transactional factors”, the “human factors” suddenly become a problem. If the seller or the buyer has market power or is somehow able to “hold-up” the other party the situation changes. Then complicated long-term contracts or integration is required to make sure that neither party abuses their power.

One problem with writing long-term contracts is not only information asymmetry on the properties of the products or the intentions of the parties and both parties usually recognize this. However, the problems do not stop here as in many cases there is information asymmetry on information asymmetry. In other words, other party could know more about the degree of information asymmetry than the other party. For example, a vast array of information can be collected about reserves of a coal mine by extensive and expensive surveying. In many cases the mines only do minimal surveys and forgo the extra information. The customer does not have any way of knowing if the mine has surveyed its reserves or not. However, the mine does. This means that the mine knows more about its coal than any potential customer but it also knows how much more it knows.

In TCE framework integration rises as a response to the problems presented above when long-term contracting is not possible or when it is prohibitively costly. It is assumed that by internalizing the production the incentives of the both companies become aligned and this way the frictions that held back production are lifted and gains realized. The central prediction of TCE is then that higher quasi-rents and higher information asymmetries lead into greater integration within an industry.

#### ***2.2.2.2.3 Empirical evidence for TCE***

Although the assumptions and predictions of TCE are fairly straightforward very little empirical evidence exists and most of it is based on case studies. This is probably because the nature of data required to test the hypothesis is very much company or case specific and is unlikely to exist in larger databases. Despite this the existing evidence supports the predictions of TCE quite robustly.

Moteverde and Teece (1982) studied the vertical integration within the US automotive industry using sourcing and manufacturing data on 133 different components used by Ford and General Motors. With advice from a company insider they constructed an “engineering effort” rating for each part or component used in a particular car model. This rating is constructed so that it proxies the know-how and other immaterial investment of the supplier and the customer in the joint-development of the part. Possessing such knowledge is not immediately transferable like blue prints or specifications but it is likely to give advantage to the supplier who was involved in the development of the part over other potential contractors for the part who were uninvolved in the production. This in turn means greater appropriable quasi-rents for the contractor and thus greater incentive for vertical integration of the supply chain. Using probit regression Moteverde and Teece find that engineering effort is indeed significantly and materially related to the degree of vertical integration in Ford’s and General Motors’ supply chains even when controlled for other relevant variables.

Joskow (1985) studied the long-term vertical arrangements of various coal-burning electrical generating plants in the United States. According to him, studying coal supply arrangements is a good empirical test for predictions of TCE because power generation and coal mining have attributes that create potential for hold-ups and appropriable quasi-rents. For example, the efficiency of the coal burning unit increases the more specific coal burner it uses and consequently the more specific type of coal it consumes. Since the quality and properties of coal deposits are not uniform across country and the consistency of deposits within a geographical area may vary, once the burner unit is installed the plant is potentially tied to one or a few suppliers. The extreme case of this is when the power plant is located at the mouth of the coal mine which effectively ties the companies to each other.

The empirical analysis is based on terms on about two hundred actual contracts between mines and power plants of various types. Joskow builds his hypothesis on the transaction cost economics approach and he observes that complete spot-market purchases and total vertical integration are merely the extremes of a wide continuum of supply arrangements. In between there are infinite number of other contractual arrangements that regulate the supply relation. Considering the nature of coal markets with its relatively few number of producers and barriers of trade due to transportation constraints TCE predicts that spot market should have relatively small role and more complex contracts and vertical integration should dominate. Joskow’s findings are in agreement with this prediction. Furthermore, inter-regional differences in coal quality and transportation capacity seem to explain variation in types of

supply arrangement as predicted by TCE. While vertical integration was not very common in general, it was very common in case of mine mouth plants, as predicted by TCE. Overall, the findings of the study were in line with TCE's predictions.

All studies that I could find did provide at least moderate support for the transaction cost hypothesis but perhaps more importantly none were inconsistent with it. For an excellent overview of empirical tests of transaction cost economics, see Joskow's (1988) paper on this same topic.

#### ***2.2.2.2.4 Property rights theory***

While TCE has clear and understandable theoretical framework and good empirical backing and it still fails to answer certain fundamental questions. Why would integration exactly solve a problem of hold ups and opportunism as it is equally plausible that such behavior could persist between different divisions of a large company? Or which one of the companies is more likely to be the acquirer? Property rights theory (PRT) largely evolved from TCE to address these concerns.

First proposed by Grossman and Hart (1986), the PRT shares many of the same assumptions as TCE. Both theories explicitly recognize the Williamson's (1973) and Klein et al.'s (1978) assumptions of bounded rationality, opportunism and the inability to write complete contracts. They also notice that at times companies develop "relationship specific assets" which over the investment's life-time yield "quasi-rents" that arise from these assets having higher value in existing relationship than in any other use outside the relationship. Furthermore, both models recognize the presence of information asymmetries; either a one party knows more than the other party or then the (managerial or other type) efforts of either or both parties cannot be objectively verified by a third party such as a court.

Where PRT deviates from TCE is that it defines integration much more specifically than TCE. Grossman and Hart define ownership in terms of control rights to assets. There are two kinds of control rights to assets, specific and residual. Specific rights give the holder the right to the aspects explicitly stated in the contract whereas residual rights give rights to aspects not excluded by a contract. The control of these residual rights is understood as a definition of asset ownership for integration purposes. For example, the legal owner of a car could be a leasing company; however, the rights of the leasing company are limited by the leasing contract. The lessee has the residual rights to the car.

The result of this distinction is that two companies are considered integrated even if they do not belong to the same corporate structure as long as the other party has residual control rights to the relation specific asset. As an example consider an insurance company. It can sell its policies through in-house branch or independent but exclusive brokers who work in a separate company. As stated above, in PRT framework the relevant variable to consider is not who legally owns a particular entity but to whom does the asset that generates the revenue stream belong. In this case the relevant asset is the client list and rights to those clients. If the insurance company owns the client list, the broker cannot take those clients with him even if the business relationship with the insurance company is terminated. If the broker owns the list, the company cannot sell its other products directly to the customer or object if the broker takes away the customers in case the relation with the broker terminates.

The basic model of Grossman and Hart (1986) is that two parties could make a relationship specific investment(s) that will generate quasi-rents. However, the performance of the investment will partially depend on how the two parties behave after the investment has been made. The problem is that before making the investment the two parties cannot write a contract to divide the quasi-rents taking into account all possible contingencies or because the behavior of the two parties are not objectively verifiable<sup>13</sup> to a third party. Simply integrating the two companies will not solve the problem because symmetric nature of control; purchase of ownership of residual rights by one party will deny them from the other. This merely changes the ex-ante distortions for both parties and does not eliminate them. This highlights the fact that principal-agent problems underlie all organizational forms and integration does not only bring benefits but also costs.

How does PRT solve the distortion problem? PRT does not propose solutions as such. It merely compares different ownership structures to the theoretical non-distortions case and shows what happens if one is chosen over the other. Grossman and Hart state that in case the impact of the other company's ex-ante investment decision to the company's benefit is relatively small compared to the total benefit and this holds true for both companies, then non-integration is the most efficient choice. If on the other hand one company's benefit is more sensitive to the ex-ante investment decisions of the other company than vice versa, then

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<sup>13</sup> For example, managerial or creative effort.

the more sensitive company should own the relevant asset. It is worth noticing that even the least distortions solution suggested by PRT does lead into distortions in ex-ante investment.

To give an example, consider the insurance company example from above (Grossman, Hart 1986). Suppose that the insurance sales agent needs to devote effort in gaining customers. However, how much effort he puts into gaining the customer determines are the customers likely to renew their policy next year. If the agent puts in only minimal effort, the customer is likely to change broker next year. This, of course is undesirable from the perspective of the insurance company who wants to have long-term customers because retaining and old customer is much more profitable than acquiring a new one. If the agent is paid a lump sum for each new customer, it is obvious that he will put in minimal effort and will only deliver temporary customers. To circumvent this, the company needs to back-load the commission so that the initial commission is below the minimal effort to acquire a new customer but pay the agent a renew commission that is above the agent's servicing costs for getting the customer to renew the policy.

This back-loading itself does not have any implications for who should own the client list unless there are aspects that cannot be contractually agreed before-hand. There are two types of aspects that distort the ex-ante investment decision for both parties: a) aspects that hurt the company b) aspects that hurt the agent. It is easy to imagine what could be such aspects. The company can be hurt if the agent controls the list and decides to switch the customers to another insurer just to boost his profit even though the change does not benefit the ultimate customer. The agent on the other hand could lose if the company owns the list and makes changes to the insurance product that will adversely affect the salability or renewability of the insurance policy. The agent cannot switch the customers to a better insurer and thus faces losing the customers.

PRT suggests that the party that is more sensitive to the actions of the other party should own the list. This can be demonstrated by comparing two different types of insurance policies of which propensity to be renewed has different sensitivities to the actions of the agent. Consider life insurance and car insurance policies. Life insurance policies are paid out only when the insured dies and are typically not very often switched, at least not because the agent gave bad service during the claim processing. The renewal of the car insurances on the other hand is more dependent on the quality of continuous service by the insurance agent. In this way the car insurance is much more sensitive to the agent's actions than the life insurance. As noted

by Grossman and Hart, this is reflected in differences of ownership of the client list in different insurance markets. Life and other insurance insensitive to agent's continuous efforts are typically owned by the insurance companies where as the list is mostly owned by the agent in other types of insurance where the continuous customer service of the agent is more important.

The PRT framework presented above is restrictive in a sense that it only considers the managerial incentive effects of integration. In reality integration may bring costs and benefits other than just the impact on managerial behavior. To overcome this limitation Hart and Moore (1990) expanded the analysis by considering cases when asset is being worked by several people some of who have and some of who do not have the ownership rights to that asset. In addition, they specialize the meaning of residual control rights to deciding who has the access to the asset i.e. who can and who cannot use the asset. In their model they analyze who should own an asset under various conditions such as when one or more parties can make asset specific investment in his human capital while others cannot or when multiple complementary assets exists and one or more parties are crucial in utilizing these assets to create surplus. While it is redundant to go through their model in any greater detail it is worth noting that unlike largely verbal TCE, this PRT model yields mathematically well-defined and testable hypothesis then TCE.

Despite the well-defined PRT model, relatively little empirical examining the relevance of PRT has been conducted. Whinston (2003) evaluates the empirical evidence provided by the previous empirical studies from TCE perspective and assesses the relevance of those results for PRT. He finds that many of the existing studies are not suitable for testing PRT, especially cases in which the TCE and the PRT have opposite predictions. For example, consider a case where a change in business environment reduces overall quasi-rents but make one party more sensitive to the other party's non-contractible actions. Now TCE predicts that incentive to integrate has been reduced while PRT states the opposite. However, testing certain aspects of PRT can be even more daunting than testing TCE. For example, PRT assumes that benefits to different agents are not independently verifiable by third parties. Finding a natural experiment where the benefit is even in theory unobservable possesses considerable challenges to the researcher. However, relaxing some of these strong or stringent assumptions might not entirely nullify the model while permitting a reasonable natural experiment to be devised. Empirical testing of PRT is likely to be a fruitful field for future research.

### 2.2.2.3 *COLLUSION HYPOTHESIS*

There is a considerable debate whether vertical mergers are anti-competitive. Traditionally the courts in the US have viewed vertical mergers with suspicion on the grounds that an upstream or downstream merger could prevent the competitors from accessing either raw materials or customers. Starting from the 50s this “foreclosure theory” was adopted as reasoning in many leading court cases. If a supplier with monopoly power was acquired by one of its customers, the acquirer could then in certain cases gain competitive advantage over its competitors by using price discrimination or refusing to sell raw materials (Perry 1989). History has a few well-known anecdotes of this happening. During the early days of oil industry, the railroads were the only viable way of delivering oil from inland wells in the US mid-west to markets in the East and West coasts. Standard Oil Trust was accused of integrating upstream to railroad companies and then raising the rail transport prices for its competitors to uncompetitive levels (Svanström 1964). However, the extent of this practice, if it happened, and the ultimate consequences of it remain anecdotal. Still, it serves as a very understandable example how a vertical merger could be anti-competitive.

The harmfulness of vertical mergers was first seriously questioned in the early 80s when Chicago school contested the long-standing view of vertical mergers as anti-competitive. However, even before Chicago school, Joseph Spengler (1950) had already presented his case for vertical integration under monopoly conditions in multiple stages of production or the case of double marginalization<sup>14</sup>. He showed that in certain cases vertical integration will necessarily increase total welfare. The evolvement of TCE, PRT and efficiency arguments has meant that the academic literature now has much more comprehensive view on the issue than before. More recently the Chicago centered view has evolved into a post-Chicago approach which combines the economic analysis of the Chicago school with methodology of modern industrial organization theory. This has lead into renewed interest in the competitive implications of vertical mergers in recent decades.

Nocke and White (2007) investigate the impact of vertical mergers in the incentives for collusion in upstream markets in oligopolistic intermediate goods markets. They find that vertical integration creates two opposing effects on the incentives to collude in the upstream:

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<sup>14</sup> Double marginalization refers to a case where single product monopoly on both vertical stages exists. Merger between the two companies will then result in elimination of the welfare loss associated with applying monopoly pricing twice.

the “outlets effect” and the “punishment effect”. Outlets effect is created when one of upstream producer integrates downstream. Now the integrated downstream buyer will always prefer to buy from the integrated upstream company thus reducing the potential outlets of the other non-integrated companies and thus profits arising from deviating from the collusive agreement. In this way the outlets effect facilitates upstream collusion. The punishment effect on the other hand works the opposite way and incentivizing the integrated upstream producer into breaking collusion since any profits that the downstream buyers, who benefit from deviations from the collusive agreement, are shared with the upstream producer. Thus the integrated upstream company is less hurt from the breakup of the collusion than its non-integrated rivals. The main result of Nocke’s and White’s research is that outlets effect always dominates the punishment effect facilitating collusion in the upstream. However, this result is valid only for case of the first vertical merger in a non-integrated industry but does not necessarily hold if the industries are further integrated.

In a continuation study Nocke and White (2010) investigate what kind of factors affect the size of the impact on collusive schemes. In their model they find that large downstream buyers are the most disruptive for competition. This is because the outlets effect grows faster than the punishment effect with the size of the merging downstream firm. As a result they suggest that the competition authorities should look for big mergers in already thinly competed industries without prior integration.

Chen (2001) argues that besides the impact on incentives if the upstream producer the vertical merger will also impact the incentives of a downstream producer and its competitors in choosing a supplier. He finds that under fairly general conditions a vertical merger will have, like Nocke and White found, two opposing effects: efficiency gain and collusive behavior. Which effect is dominant depends on the cost of switching suppliers and downstream product differentiation. Vertical mergers tend to benefit consumers when the cost of switching supplier is low (i.e. little to no relationship specific assets) or when the downstream product market is very differentiated. Customers are worse off when the supply chain has large relationship specific assets and the downstream products are close substitutes.

As seen from cases above, the competitive impact of a vertical merger is far from being straightforward as the impact on competition can go either way depending on the specific circumstances of the merger. Most of the studies on competitiveness of vertical mergers are,



as studies cited above, largely theoretical exercises. There is very little empirical evidence to support any of the claims above and is likely to be field for further studies in the future.

#### **2.2.2.4 OTHER MERGER MOTIVATORS**

In addition to tangible synergies, market failures and collusion, other considerations have been proposed for vertical merger motivation. Supply security is a major concern not only to states but also to large corporations. Desire to secure a customer or a supplier is a potential reason for vertical mergers often cited in strategy literature. This is can often thought to be closely related to reasons put forward in transaction cost economics and property rights theory. However, there is a special case to this which takes us outside the corporate world. Political analysts' and commentators have a wide consensus that the main reason for China's aggressive expansion of economic ties to various resource-rich but cash-strapped African nations is motivated by desire to secure flow of raw materials to fuel China's growing industry.

Buckley et al. (2007) find evidence that foreign direct investments of state owned Chinese multinational corporations is associated with high levels of political risk and natural resource endowments. Furthermore, there is evidence that many FDI projects undertaken by these companies are not justified on risk adjusted basis on purely economic grounds. They find this consistent with the notion that the behavior of these corporations is consistent with the political goals of the Chinese government. Resource security, besides access to foreign markets, technology acquisition and fostering foreign policy relationships, are officially stated goals of Chinese government (2004). It would be very surprising if the government did not use its influence on the state owned enterprises to foster these goals.

Another other potential merger motivation for a company could be caused by a financial distress of a supplier. Suppose that a supplier under financial distress could save money by using inferior raw materials or quality control and suppose further that it is difficult or costly for the customer to verify the quality of the output in the short-term. For example, a cement factory could use inferior quality raw materials in making its products which would cut its costs but lower the quality of its output. If the drop in quality cannot be immediately observed the customer is not be aware of the inferior quality in the short-term and end ups paying too much for its input. Being aware of this, the customer might want to prevent this kind of opportunistic behavior, by acquiring the supplier if switching the supplier is not costless.

### **2.2.3 CONGLOMERATE MERGER**

Conglomerate mergers involve two or more companies operating in unrelated business activities. As a rule of thumb, a merger is conglomerate if it does not meet the requirements of vertical or horizontal mergers. Weston (2004) recognizes 3 types of conglomerate mergers: product extension mergers or concentric mergers, geographic market extension mergers and pure conglomerate mergers. Concentric mergers are, according to Weston, companies operating in similar business activities but not necessarily compete with each other. For instance, a retail bank merging with an insurance company would be an example a concentric merger. In a geographic market extension merger the companies involved do not compete in any existing geographical area but share a competing product or service. Pure conglomerate mergers are those with no operational links whatsoever. In this study only the pure conglomerate mergers are classified as conglomerate mergers and the two others are re-classified as horizontal or vertical mergers. In practice this means that mergers not classified as either of the aforementioned classes are assigned to be conglomerate.

#### **2.2.3.1 MOTIVES FOR CONGLOMERATE MERGERS**

Compared to horizontal mergers, conglomerate merger motives are fairly little studied topic. Most of the research has focused on the profitability of such mergers and less thought have been given to the merger motives. Due to the lack of obvious economic reasons for pure conglomerate mergers, traditional view has been that conglomerate mergers are negative NPV projects for the acquirer's shareholders primarily motivated by agency or managerial hubris motives. Managers may desire to diversify their own income stream as the majority of their income and benefits or assets (salary, stock option plans, perks etc.) are dependent on the value of the company. For various reasons it could be costly or impossible for the manager to diversify his income portfolio efficiently, for example because of restrictions on selling management stock options. An alternative way for the manager is then to diversify the income stream of the company. Diversification of business does not benefit shareholders as they can achieve the same outcome more easily (Levy, Sarnat 1970) and without the associated legal costs and loss in managerial efficiency. Another important aspect regarding the corporate diversification is that if the cash flows to the company become more stable it could constitute value transfer from equity holders to bondholders as suggested by the Black and Scholes option pricing formula (Black, Myron Scholes 1973). For these reasons it is very likely that shareholders can expect to gain very little but stand to lose in corporate diversifications.

Other agency motives relevant for conglomerate mergers are managerial entrenchment, free cash flow problem and empire-building motives. However, these motives are discussed in more depth in the section 2.3.3 Value destroying theories.

Value creating motives for conglomerate mergers have also been proposed. Managerial synergy hypothesis suggests that certain managers or management teams have relative advantage in managing multiple firms and this way increase shareholder value. Financial synergy hypothesis proposes that larger companies have better access to capital markets and a conglomerate merger could create financial synergies as mentioned above (Weston, Mitchell & Mulherin 2004). Finally, the market discipline hypothesis (Manne 1965) formulates that conglomerate takeovers are motivated by desire to buy firms underperforming due to incompetent incumbent management. By acquiring the company and replacing the management the acquirer can realize significant gains. In the following paragraphs research on some of these theories is briefly discussed.

#### **2.2.3.2 EMPIRICAL EVIDENCE OF PROFITABILITY OF CONGLOMERATE MERGERS**

There are various theoretical reasons to suggest that the conglomerate mergers are and were driven by agency motives such as diversification (Levy, Sarnat 1970, Amihud, Lev 1981). However, also synergetic motives have been put forward as well (Matsusaka 1993). The evidence regarding the primary motive for such transaction is unclear. Returns to acquirer's and target's shareholders have not been shown unambiguously negative or positive. This suggests that multiple motives might exist at the same time.

Examining the mergers announced during the 1960s Amihud and Lev (1981) investigate do the firms classified as manager controlled firms engage in different kind of M&A activity than the firms classified as owner controlled. They found significant differences in the behavior of these two types of companies. The manager controlled firms are more likely to engage in conglomerate or diversifying mergers than owner controlled. Furthermore, they found a significant link between the managerial control of the company and the  $R^2$  value of a regression matching income/equity ratio of an individual company against the corresponding average rate of return of all the companies in the economy. Greater  $R^2$  value suggests greater diversification of the company. To better understand the logic of this, consider an extreme case where a company is active in all industries. Then the company's income would behave very much like the aggregate average income of all of these industries. This finding supports

the notion that manager controlled companies are seeking to diversify risks supporting the idea that the companies are engaging in conglomerate mergers for diversification.

In a study a few years later Amihud et al. (1986) suggest that managerial diversification is not necessarily bad for the shareholders in when asymmetric information is present. Their work relies on various optimal contracting models and suggests that when measurement of the managerial effort is difficult the diversifying merger may be beneficial to both managers and the shareholders. This implies that if market for corporate control works efficiently the predicted motives for owner controlled and manager controlled companies are different. Manager controlled companies would initiate beneficial diversifying mergers whereas owner controlled companies would undertake a conglomerate merger only when a true synergistic reason exists. The empirical results suggest difference in announcement returns between conglomerate mergers announced by manager controlled companies vs. owner controlled companies supporting the hypothesis.

Further empirical evidence from the 1960s' merger wave supports the view that conglomerate mergers have been beneficial to shareholders and were not primarily motivated by agency issues (Matsusaka 1993). Matsusaka studied alternative motives for the US conglomerate mergers of the 1960s. The mergers could be motivated by shareholder value increasing reasons, such managerial synergy or market discipline, or by various agency issues, most importantly diversification. Basing his research on stock market response of the announcement he found that, overall, the market seemed to reward conglomerate mergers and that also the acquirer's shareholders benefitted from the market response. This suggests that the acquisitions were not driven mainly by agency motives. In explaining the positive market response Matsusaka found that the response tended to be negative if the target management was fired providing support for the managerial synergy hypothesis against the managerial discipline hypothesis. However, interestingly enough he found relationship between the board independence and market reaction to the announcement: companies with high insider-to-outsider ratio earned significantly less than those with low ratio suggesting that those transactions could have been motivated by agency issues. This is consistent with Amihud's and Lev's (1981) findings.

## **2.3 MERGER THEORIES**

The most fundamental question in merger research is why mergers occur in the first place. Why companies choose to merger instead of forming strategic alliances, buying required

input or use any other alternative mean to achieve their desired goal? In this section I will present general theories of why mergers occur but discussing only the theories which are not specific to any particular merger type such as vertical or horizontal mergers. Merger theories specific to a particular type of merger were discussed in the section 2.2.

Several generic mergers theories have been put forward over the decades and I classify them into three broad groups based on if real wealth is generated or not. The groups are 1) value increasing theories, 2) value redistributive theories and 3) value destroying theories. Weston et al. (2004) use a slightly different classification where the theories are classified based on the value implications for the shareholders.

### 2.3.1 VALUE INCREASING THEORIES

Theories that postulate that motivation for merger is to gain an increase in the combined value for stakeholders are classified as “value increasing theories”, “synergy and efficiency theories” or “neo-classical theories”. This increase of shareholder value is a result of a real improvement in the operations of the company as opposed to result of a mere redistribution of wealth. It could be due to economics of scale or scope, cross-selling opportunities, reduction in fixed costs, elimination of redundancies or generally better management. Also increased market power could also be viewed as one such factor although from societal perspective it represents value redistribution or even value destruction due to deadweight losses generated by the increased monopoly power.

Majority of studies conducted suggest that mergers do add value even if not all kinds of mergers are value adding. The biggest problem in comparison of the studies lies in the differences in methodology. Most studies with equal observation weighting have found that mergers create significant positive returns to targets and positive or zero returns to acquirers. For instance, Bradley, Desai and Kim (1988) find that successful tender offers increased combined value by an average of 7.4%, though the returns to acquirers were largely insignificant. A tirade of subsequent studies has found similar results.

In addition to stock market based event studies, a number of accounting and cash flow based studies have investigated the profitability of mergers. For instance, Healy, Palepu et al. (1992) studied post-merger performance of the merged entity using accounting data. They find that the companies enjoy increase in their post-merger operating cash flows which is due to increased efficiency in utilizing operational assets. There was no evidence to support notion that the observed improvements came from cutting funding from capital investments or R&D.

Shleifer and Vishny (2003) suggest that markets are inefficient while managers are fully rational and seek to take advantage of market's misvaluations of companies through acquisitions. In their model, mergers arise as a form of arbitrage where companies seek to acquire undervalued companies. This could take place as relatively more overvalued company taking over relatively less overvalued company and using its stock as payment method.

### **2.3.1.1 OPERATIONAL SYNERGIES AND EFFICIENCIES**

Operational synergies and efficiencies are a broad class of gains that could be arising, for example, from economies of scale and scope, technological reasons, rationalization of production or any other synergies in production. While strictly speaking it is not impossible to have operational synergies in all types of mergers, common sense suggests that the potential for such is highest in horizontal and vertical mergers and more limited in conglomerate mergers.

Economies of scale are said to occur when the average cost of production falls as the production increases. According to Damien and Röller (2005), there are two types of economies of scale: the short-run and long-run. The short-run economies of scale refer to cases in which the production involves non-scalable element, a kind of a fixed cost, which is not dependent on the production level. This could be billing or accounting department. Merger will allow companies to realize cost savings by eliminating the function in one of the companies. Long-run economies of scale in turn refer to situation where doubling of all factors of production lead to more than double increase in output. These efficiencies could arise from number of reasons such as when the output of the company is small, it may be preferable to invest little and to inferior technology. As the size of the company increases, more can be invested and to better technology. Furthermore, larger plants enable greater specialization which in turn can increase overall productivity. Finally, as a result of certain physical laws, energy costs associated with larger machines are proportionally smaller than those with smaller machines.<sup>15</sup>

Economies of scope occur when production of two related goods in a same plant reduces the overall input costs. This could be due to a common input such as crude oil for production of

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<sup>15</sup> Meaning that large machines are typically more energy efficient per unit of output than smaller machines.

diesel and benzene<sup>16</sup>. Similarly selling banking and insurance products in the same branch allows cost savings for producers and customers alike.

Rationalization, according to Röllner, refers to cost savings arising from shifting production from one facility to another without lowering the combined production possibilities of the merged company. Prior to the merger it is possible that marginal costs of production are different for different production plant. This could be due to a difference in capital used in production, due to a competitive advantage such as a patent or difference in capacity utilization. Shifting production from high marginal cost facility to a low marginal cost facility lowers overall costs of the company.

Technological reasons for increased efficiency stem from either diffusion of knowledge or increased incentives for research and development. One or both of the companies might have superior knowledge in one or more areas of their business which can be applicable to the other company. Diffusion of knowledge as a result of the merger can allow both of the companies move closer to their joint production possibilities frontier. Merger could also create incentives to invest more into R&D, for instance if there are economies of scale in R&D or if R&D of the companies are somehow complementary. For example, civilian and military research on nuclear energy is highly complementary and even today military and civilian facilities of nuclear research are often joined.

Although there is ample of research suggesting that mergers create value through reasons presented in this subsection, very little research has been done to investigate directly the efficiency hypothesis in production facilities. Most evidence is indirect as presented in section 2.2.1.1.1. Despite strong indirect empirical support for the efficiency hypothesis and considerable explanatory power, it fails to predict or explain merger waves or why a particular method of payment is used in completing the transaction.

### **2.3.1.2 STRATEGIC CONSIDERATIONS**

Corporate strategy is an entire research branch of its own so it is only natural that in this subsection I can only lightly touch the topic. However, I attempt to give the reader an idea what kind of strategic reasons for mergers can exist. I differentiate between two types of strategic levels: the *corporate strategy* and the *owner strategy*.

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<sup>16</sup> Actually benzene is waste product of making diesel.

Corporate strategy is the strategy the corporate executives formulate and execute to maximize the company's value. Perhaps the most famous article on corporate strategy is Porter's (1979) five force's model. It describes how five different larger "forces" shape the competitive position of an industry and a position of a company within its industry. These forces, rivalry among existing competition, threat of new entries, threat of substitute products, bargaining power of suppliers and bargaining power of customers, according to Porter, define industry's and company's profitability. Within this framework companies are able to influence these factors through strategic mergers and acquisitions. Companies may even want to strategically realign themselves or enter into new, unrelated business areas. Mergers can facilitate this transfer better than trying to develop those resources on their own.

The owner's strategy is the strategy that the owner of the company formulates and executes for maximizing his portfolio's value and in this context the corporation is just an asset within a larger portfolio. To highlight the difference between the two strategies consider an enterprise with a single large owner. This owner could be a family or a rich individual or even a sovereign state. The ultimate owners of this enterprise can have strategic goals that not necessarily maximize of the value of the enterprise or other shareholders. These goals are communicated to the managers of the company who in turn formulate their own corporate strategy with the constraints given by the owners.

Suppose a shareholder with a controlling stake of company is financially constrained and unwilling to give up controlling rights. He is likely to have significant proportion of his personal wealth in tied up in company meaning that his personal portfolio is sub-optimally diversified. Under these circumstances he might wish to balance his portfolio by having the company to undertake diversifying mergers. These mergers are likely to add nothing to the company value and quite likely even reduce it. From a well-diversified minority shareholder's perspective the mergers are undesirable but from the majority shareholder's perspective it is very desirable as it will enable him to diversify his assets without giving up the controlling rights in his company.

Similar logic can be used even if the diversity of the majority shareholder's asset portfolio is irrelevant. The "portfolio" can consist of non-financial assets as well. For example consider the Chinese state owned enterprises (SOE). During the past decade Chinese state owned corporations have aggressively expanded to other emerging markets and in particular to Africa. Buckley et al. (2007) found that contrary to multinationals of developed world,



Chinese multinationals seem rather insensitive to political risk. This is particularly true in African context where Chinese companies have been eager to expand. The authors suggest that this could be result of the state's ownership artificially and falsely lowering the cost of capital for the companies. In practice this is achieved either by issuing of direct orders from the state or through subsidized loans through the state owned banks. In another study Deng (2004) noted that the government's desire to secure critical raw materials to fuel the Chinese industry is likely to have influenced the Chinese SOEs decision to internationalize to markets in Africa and Latin America. Being very dependent on exports of manufactured goods, Chinese government has special interest in making sure that its industry is shielded from sudden shocks in raw material availability. For more detailed analysis see section 2.2.2.4.

### **2.3.1.3 FINANCIAL SYNERGIES**

Financial synergies occur when the merging companies are able to obtain financing at better terms than as stand-alone entities. There are two proposed ways how this could happen. The first is that the merged entities effectively guarantee each other's debt. This can result in the merged company having to pay lower interest on its debt and have larger borrowing capacity than either of the two companies alone. While this alone should not enhance the company's value, the increased borrowing capacity can enable the company to undertake positive NPV projects that it otherwise would have been forced to pass on. Thus the increase in the enterprise value comes from the capacity to take additional positive NPV projects.

The other way the financial synergies could be formed is if the external financial markets are unable to correctly price prospective projects of the companies due to information asymmetry or equivalent reason. Myer and Majluf (1984) present a model where the inefficiencies of external capital market can be overcome by using intra-firm internal capital market. A cash poor company facing lucrative investment opportunities could be acquired by cash rich company with limited investment prospects. The excess cash from the cash rich company could then be directed to the cash strapped company with plentiful of investment opportunities more effectively than that the external markets could do. Internal markets could work more efficiently than external under certain assumptions relating especially to information asymmetries.

Both of the hypotheses above assume rational and beneficial management which is in direct confrontation with agency theory. Agency theory by Fama (1980) suggests that presence of excess cash reserves and cash flows actually incentivize management to financial

mismanagement. These two hypotheses represent two opposing but not mutually exclusive views. For more on agency theory see section 2.3.3.

#### ***2.3.1.4 ELIMINATION OF UNDERPERFORMING MANAGEMENT***

Disgruntled shareholders are not the only source of fear for corporate executives. In fact, risk of being punished by shareholders may be minimally low for managers of companies who have very atomistic shareholder base. Organizing a proxy-fight against entrenched management is costly and not guaranteed to succeed. However, inefficient managers might be disciplined other ways through mechanism called “the market for corporate control”.

Originally proposed by Manne (1965), the market for corporate control uses proxy fights, share purchases and mergers as way for punishing inefficient managers. Suppose a company with numerous atomistic shareholders with each very little individual incentive in trying to contest the incumbent management. Because of the mismanagement the stock price of the company is depressed and collectively the shareholders have a lot to gain by firing the management. However, in practice organizing shareholder resistance is very difficult and no one is willing to invest the time and money in it unless they have a considerable stake in the company. Despite this, the company’s depressed stock price is also the key to the salvation of the company as an external party could through “hostile” takeover seize the underperforming company, fire the incompetent management and turn the course of the company while realizing a sizable gain through stock price appreciation. According to Manne, mergers represent the most efficient way for the market for corporate control to function.

There is considerable evidence suggesting that market for corporate control exists and that it works in the favor of the shareholders. In his article Jensen (1983) summarizes the evidence for and against for the hypothesis of the market for corporate control. He concludes that overall target’s shareholders seem to benefit, acquirer’s shareholders are no worse off and generally speaking it is difficult to find examples where acquirer’s management action would hurt shareholders in M&A context with the exception of defense tactic’s employed by the target’s management.

#### ***2.3.1.5 SIGNALING***

Under assumption of semi-strong market efficiency markets should react to relevant new public information or revelation of previously private information. This information needs not to be explicit or direct but can also be implicit and indirect. The mere action of making an offer for a particular company could reveal previously private information about the acquirer,

target or the industry as a whole leading into a stock market reaction on announcement. This would be the case even if we assumed that mergers are value neutral i.e. they do not create or destroy value. In this context the markets react to the implicit information carried in the merger announcement rather than to the merger itself.

Bradley, Desai and Kim (1988) report that in their sample of tender offers the value of the company reverts back to its pre-announcement value if the tender is retracted or fails. This would suggest that signaling is not prevalent among tender offers.

### **2.3.2 VALUE REDISTRIBUTIVE THEORIES**

Besides arguing that mergers create or destroy value, it is also possible that mergers are irrelevant in terms of total value created representing merely a redistribution of wealth. The redistributive theories propose that there can be a response in stock market price but any observed appreciation in stock price is actually a result of redistribution of wealth from other stakeholders such as the government, bondholders, consumers or labor unions. In other words, any gains achieved are away from some other stakeholder group and in the broader perspective cancel out each other.

#### **2.3.2.1 HUBRIS HYPOTHESIS**

Hubris hypothesis by Roll (1986) proposes that the management has overestimated the true value of the target and is willing to overpay for it. This means that the shareholders of the acquirer lose but this loss is offset by the gains of the target's shareholders. Roll proposes that this overpaying might be a form of the winner's curse.

In Roll's model, the management of the acquiring company is makes a private assessment of the value of the target. However, there is an inbuilt bias in this system. Shareholders of the target are rational and will not sell the company below its market value. If the acquirer's management deems the true value of the target to be below its market value the merger will not proceed. Merger is attempted only if the acquirer's management's private valuation exceeds the market value. Assuming that the private valuation is a random variable with expected value of fair market valuation and non-zero error term, we observe only "bad" mergers taking place. This model would explain the modest or non-existent gains to the bidders.

Role of CEO overconfidence was analyzed in a study by Malmendier and Tate (2008) who using various proxies for overconfidence found that over confident CEOs are significantly and materially more likely to overpay for their targets and thus destroying shareholder value.

This means that hubris mergers do not create new value as the gains to the target are offset by the losses of the acquirer. While typically this means that under hubris model mergers do not create overall returns, it does not actually rule out the possibility that synergies exist even when hubris is present. In this case hubris is visible in the overpaying by the acquirer and total creation of value.

### **2.3.2.2 MARKET POWER**

It has been proposed that mergers are anti-competitive and the stock market gains merely reflect the collusive power brought about the merger. This could happen horizontally where customers and possibly suppliers lose out or vertically where the horizontal competitors are denied of raw materials or customers. However, according to Weston (2004) empirical evidence does not support this view although there is some evidence that market power plays a minor role in creation of merger gains. Among others, Fee and Thomas provide evidence supporting this position in horizontal mergers (Fee, Thomas 2004). Creation of market power as a motive for mergers is more extensively discussed in section 2.2.1.1.2.

### **2.3.2.3 OTHER PROPOSED REDISTRIBUTIVE HYPOTHESES**

It has been suggested that mergers might also occur in order for companies to buy unused tax credits which would merely represent a reallocation of wealth from government to the shareholders without actually creating any new value. Hayn (1989) finds evidence that unused tax credits significantly explain the abnormal returns of mergers and that probability of a merger going through is affected by whether it is granted tax-free status by the IRS or not. However, the extent of how many mergers that are materially affected remains unclear.

Asquith and Kim (1982) studied if the observed gains from mergers could be value redistributed from bondholders. In principle, the merger could affect the risk-return profile of the company where increased risk could boost the equity value of the company while reducing the debt value. However, they find no evidence supportive of the hypothesis.

Mergers are often associated with news of layoffs and wage and/or benefit cuts. For various reasons the new management might be able to “shock” the unions and workers in the early days of the merger and be able to renegotiate labor contracts. The saving from these could

then be used to benefit the shareholders. Testing the hypothesis that hostile mergers target companies where employees are able to extract largest rents or quasi-rents Neumark and Sharpe (1996) studied if probability of being a target for hostile takeover was related to presence of high salary premium. Generally speaking they found no evidence for such behavior.

### **2.3.3 VALUE DESTROYING THEORIES**

Extensive literature exists that proposes mergers are actually value destroying ventures. Common to all these theories is the role of the acquirer's management as they source of the value destruction. Besides the obvious and simple "the management is incompetent" explanation, a more interesting concept was proposed in the 1970s. Derived from the agency theory, set of "agency problems" describe management that is reasonably rational or competent but act in the best interest of itself rather than that of the company's owners. The root of the problem is the fact that in the modern corporation the ownership is separated from the management of the company. If not monitored or incentivized properly the management could actually be acting in its own interest rather than that of the shareholders'. For an overview of the agency literature see Eisenhardt (1989).

"Agency problem" is an umbrella term that comprises a large array of different models, most common of which are presented in the following sub-sections. The agency problems have been widely documented in a number of interesting studies and are a source for a growing literature.

#### **2.3.3.1 FREE CASH FLOW PROBLEM**

Perhaps surprisingly, the root of the free cash flow problem is relative well-being of the company. In his article Jensen (1986) proposes that excess free cash flows incentive managers to wasteful investment rather than distributing the excess cash to the shareholders. Free cash flow is defined in this context being the excess of operational cash flows after financing of positive NPV investments and mandatory financial payments such as repayment of debt, interest and regular dividends. The management has incentive to invest this excess cash wastefully and according to Jensen, large part of this wasteful investment flow is directed to wasteful acquisitions.

The risk for value destroying merger is elevated if the company has large free cash flow and plenty of unused debt capacity. Harford (1999) finds support for Jensen's hypothesis. He studies companies with large cash reserves and finds that those companies are more likely to

engage into M&A activity than companies with limited cash reserves. Furthermore he finds that acquisitions by cash rich firms have negative abnormal returns and are more likely to be diversifying and have fewer bidders.

### **2.3.3.2 DIVERSIFICATION PROBLEM**

Amihud and Lev (1981) suggest and provide evidence that the managers wish to reduce their employment risk through diversifying mergers. This is easy to understand considering that most top managers have disproportionate share of their assets and future cash flows tied to the fortunes of the company they are managing. As they often cannot achieve diversification through markets, they could seek to achieve it through lowering the business risk of the company they are managing. Diversification problem was more extensively discussed in Section 2.2.3.1

### **2.3.3.3 MANAGERIAL EMPIRE-BUILDING**

Jensen (1986) suggests that besides desire to diversify, the management engages in M&A activity in order to realize private benefits. Top managers of large corporations might enjoy the status associated with running a large corporation and seek to maximize the prestige benefits of their position through acquisitions. Larger companies more often than not also offer better benefit than smaller companies to its managers. Finally, if the management compensation is tied to sales figures, number of subsidiaries or other size metric it could encourage myopic expansion of the company instead of improving its profitability.

Empire-building is a fairly little studied topic in the management literature due to difficulty in determining what constitutes empire-building behavior and what is merely bad managerial practice. It may be easy to conclude that corporate jets, luxurious uptown HQ and fleet of executive limousines add little value to shareholders and are mere corporate splurge; however, it is considerably more difficult to determine the optimal number of employees or sales offices in a given region. In most cases managerial excess can only be detected indirectly based on the managerial results. Hope and Thomas find that (2008) multinational US corporations that do not voluntarily disclose geographic earnings results have above average sales and below average profitability in comparison to their peers that voluntarily disclose the geographic earnings results. This is consistent with Jensen's (1986) suggestion that empire-builders are more likely to boost sales and neglect profits.

## **2.4 M&A GAINS AND RESEARCH**

Value creation in mergers has been the primary interest in merger studies. Number of studies over the decades have studied do mergers actually create value and if so, what factors seem to be the most important in the value creation. The consensus is that gains observed do represent a genuine value creation and not a redistribution of existing wealth. Since then the focus has been on identifying the factors that foster value creation and research has identified a great number of significant factors ranging from deal specific to company and industry specific factors.

### **2.4.1 ACQUIRER AND TARGET GAINS**

Virtually all merger studies have found positive returns for the shareholders of the target. Under the assumptions of free-markets and rational actors this is not a surprise. No rational investor is willing to give up their stake of a company for less than its prevailing market value. Furthermore, all merger theories suggest that the acquirer is willing to pay a premium for the target, be it for synergies, hubris or agency motivated. To summarize the results of the studies reviewed, majority of the papers indicate that merger related returns to targets are in the range of 15-30% and acquirers on average gain nothing in percentage terms.

Acquirer gains are much more varied than target gains. Although some studies report of positive acquirer gains (Bradley, Desai & Kim 1988), most studies find that acquirer gains are not statistically significant from zero (Andrade, Mitchell & Stafford 2001) or are even slightly negative (Dodd 1980). In the following paragraphs I will briefly go through some of the studies measuring target gains in mergers. It is worth noting that the literature on merger gains is very abundant and it is impractical and unnecessary to list all studies in this section. Therefore I will review just a few to give the reader an idea.

Bradley et al. (1988) study a sample of 236 successful inter-firm tender offers between 1963 and 1984. They find that on average target's capture majority of the percentage and dollar measured merger gains. The acquirer gains are positive and significant for the whole observation period but were actually declining over time and the most recent sub-period experiencing actual negative returns for the acquirers.

Andrade et al. report 16% return on target's shareholders on a 3-day announcement window from a US sample of mergers from 1973 to 1998. The result is statistically significant and persists consistently across decades. Furthermore, the 16% return persists also across different

industries suggesting that the merger premiums are fairly similar in all types of mergers. Acquirer returns consistently but insignificantly negative across all periods.

Jensen and Ruback (1983) review a number of studies on merger gains. The studies reviewed suggest a weighted average return of 20.20% for targets of successful mergers. Acquirers on the other hand enjoy approximately zero returns although there is considerable variation. Jensen and Ruback also review the studies on unsuccessful bids and tenders and report that prior the failure or success of the merger, there is no major difference between the announcement returns indicating that markets expects roughly equal returns on both types of mergers.

## **2.4.2 BUILDING BLOCKS OF VALUE CREATION**

Various factors have been found to affect value creation in mergers. Most important of these factors are presented in this subsection. The observed results do not always support just one merger theory but are consistent with multiple explanations.

### **2.4.2.1 PAYMENT METHOD**

If mergers were only about synergies or agency issues, the method of financing the merger should have no effect on the value creation of the merger or returns to acquirer. However, this does not seem to be the case. A number of studies report that issuance of stock to finance investment projects, such as mergers, are associated with lower or negative returns (Dann, Mikkelson 1984, Andrade, Mitchell & Stafford 2001). To explain this observed phenomenon Shleifer and Vishny (2003) propose a model that suggests that mergers are partially driven by stock market misvaluations of the acquirer and the target and that this has impact of the payment method of the merger. In brief this means that companies have better knowledge about their intrinsic value than the shareholders. When the company is overvalued the management serving the interests of the existing shareholders has incentive to issue equity to buy the relatively less overvalued target. Assuming rational investors, knowing this they interpret the use of stock as payment method in absence of any other information as the overvaluation of the acquirer.

### **2.4.2.2 COMPETITION AND BID REVISION**

Classical economic truth of more money chasing same goods leads to higher prices holds also for mergers. Common sense suggests that more willing buyers should lead into higher prices just like in a public auction. Bradley et al. (1988) hypothesize that additional bids for a company arise when the initial bid is too low. They also provide empirical evidence



consistent with this notion where targets gain more while acquirers lose when multiple bidders enter the competition or if the initial bid is revised upwards.

#### ***2.4.2.3 ACQUIRER SIZE***

Moeller et al. (2004) find significant evidence that the acquirer size affects the total returns of merger indicating that large acquirers tend to fare far worse than small ones when measuring the announcement returns. They propose multiple reasons that could explain the results. Large companies could have more overconfident CEOs (Malmendier, Tate 2008) who are more susceptible hubris as proposed by Roll (1986). Larger company could also be closer to the end of its life cycle and thus have worse growth opportunities or large companies might be more likely to be overvalued and seek to buy relatively less overvalued assets with their stock (Shleifer, Vishny 2003).

#### ***2.4.2.4 TARGET MANAGEMENT ATTITUDE***

The issue of target management attitude is theoretically problematic since the effect could go either way depending on theory. According to Jensen and Ruback (1983), entrenched and inefficient management is likely to resist takeover which would remove them from power. Their attempts to resist would obviously be destructive to the shareholder value. However, if management is assumed to have better knowledge about the intrinsic value of the company than the markets like in Shleifer and Vishny model (2003), attempts to resist the takeover to extract a better price are then shareholder value increasing. Some empirical evidence consistent with both hypotheses is mentioned in Jensen and Ruback (1983).

#### ***2.4.2.5 INDUSTRIAL RELATEDNESS***

Industrial relatedness is closely related to the type of the merger and degree of that relatedness. In other words, is the merger horizontal, vertical or conglomerate and to what extent. Traditionally the focus has been on horizontal vs. non-horizontal mergers identified by SIC/NAICS codes. However, as I will demonstrate in section 4.2.2 this is very much an inadequate way of classifying mergers as it fails to properly account for vertical product relations. Why would relatedness matter? As the theories presented in sections 2.2 and 2.3 state synergies and efficiencies are more likely to be present when the merging companies are related one way or another. So the greater degree of industrial relatedness is a proxy for operational synergies. On the other hand, unrelated mergers could be more likely to be result of agency issues or other dubious motives.

Empirical evidence for industrial relatedness is surprisingly weak. Sudarsanam et al. (1996) conducted a study of different sources of value creation and its division between the acquirer and the target in the UK. The sample includes 429 successful mergers and acquisitions in the 1980 to 1990 period. Overall they find that synergies are an important source of wealth creation in mergers and one of their explanatory variables is industry relatedness. It is a dummy variable taking value of one if both companies share the same London Stock Exchange Industry Classification (SEIC) code and zero otherwise. It is worthy to note that the classification can accurately detect only horizontal relatedness as the SEIC is structurally similar to SIC/NAICS. Considering this the result was perhaps a bit unsurprising: they found no significant link for industrial relatedness and merger gain.

Chatterjee (1986) finds evidence that targets in unrelated mergers outperform targets in related mergers, non-horizontal mergers. There is no similar anomaly in acquirer returns which could suggest that in case of related, non-horizontal mergers, the bargaining power and thus the bargaining outcome between the parties is more equal. However, the data of Chatterjee's study cannot unambiguously reject or not reject such notion.

Flanagan (1996) analyzed previous studies and finds that empirical evidence seems not to support the idea that industrial relatedness enhances value creation. He then correctly points out that previous classification methods have been inaccurate and the previously observed results could merely reflect this reality. Using SIC codes in combination with "Moody's Corporate Manuals" and "Mergers and Acquisitions Magazine" he classifies a sample of 60 mergers from 1972 to 1990 as either related or unrelated. He finds that acquirers have significantly worse returns (-9%-points) in unrelated mergers than in related mergers. These findings are consistent with the notion that industrial relatedness promotes value creation.

What is the impact of industrial relatedness in the end? The jury is still out but based on current evidence it looks likely that synergies and efficiencies created by industrial relatedness are reflected in the stock prices of the companies.

## **2.5 STUDIES ON DISTRIBUTION OF MERGER GAINS**

The first notion about the distribution of merger gains was the observation that the targets tend to earn greater percentage returns on the merger announcement than the acquirers. While this view is popular and in most cases very much true, it is not the entire picture. Since then the literature has acknowledged that measuring just percentage returns gives misleading

picture as the targets are typically much smaller than the acquirers (Moeller, Schlingemann & Stulz 2004, Ahern 2012 among others). Furthermore, in estimating synergic benefits prior to a merger, it is more natural to think of the joint gains in terms of dollars or euros than in more abstract percentage terms. Examining the division of dollar denominated returns gives more realistic and tangible point of reference for estimating the distribution of gains than the more abstract dollar return.

In recent decades a larger literature has evolved that examines gains separately to the bidder and the target in mergers. However, surprisingly little attention has been given to how the total dollar gains are divided between the shareholders of the two firms. The matter of division is not a trivial matter; mergers represent the largest single transaction of any corporation and the division of gains is primary interest to both of the companies. Prior literature has mostly investigated the division question from the agency problems perspective. For example a number of studies have found that large managerial control rights increase premiums paid by the acquirers and decreases the possibility of a tender offer being accepted (Stulz 1988, Stulz, Walkling & Moon H. Song 1990). It is not only the acquirers who are affected. Wulf (2004) found evidence that the targets' CEOs trade premiums for personal power in post-merger organization in "merger of equals" deals.

While studying the agency aspects of the mergers is not wrong it gives rather incomplete view. Agency perspective is important for many practical and ethical reasons but it is hardly the only factor affecting the distribution of gains. Common sense and the standard economic argument say that the party with higher BATNA<sup>17</sup> captures the greater share of the joint gains (Whinston 2003). In other words, the party with better outside option tends to fare better in negotiations<sup>18</sup>. While better outside options can come from variety of sources, the most likely factor in context of vertical mergers is the intensity and asymmetry of product market relations. While direct threats or use of coercion in negotiations seems unlikely, the mere awareness of asymmetric mutual dependency could be enough to influence the outcome of the negotiations.

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<sup>17</sup> BATNA stands for "Best Alternative To Negotiated Agreement". It is set by the best alternative option to the merger with the other party.

<sup>18</sup> Not just in mergers but in negotiations in general.

Different motives for mergers also imply differential bargaining power and consequently different distribution of gains in a merger. In synergistic mergers where contributions or assets from both companies are required to realize the synergies the distribution of gains should be more equal than in mergers where hubris (Roll 1986) or agency motives (Jensen, Ruback 1983) are present. Managerial hubris in absence of synergies is merely going to transfer value from acquirer to target and thus means that it is the target which is going to gain the most. Similar logic can be extended to agency motives: assuming target management is rational, they will not lose out in a merger but the acquirer motivated by agency motives is.

Bradley Desai and Kim (1988) provide empirical evidence that competition among bidding firms increases returns to the target at the expense of the acquirer. Furthermore, they find that changes in the legal and institutional environment of tender offers have significantly affected the division of gains between the shareholders of the target and the acquirer.

### **3 RESEARCH QUESTIONS AND OBJECTIVES**

Existing literature suggests that there are many theoretical reasons to believe that vertical mergers have potential to create value to shareholders of both companies. Source of those gains can be increases in real efficiency and synergies (Neven, Röller 2005), reduction of transaction costs or chances for opportunistic behavior (Williamson 1973, Grossman, Hart 1986) or increases in market power (Chen 2001). Creation of joint gains in mergers raises the problem of distributing the gains in one way or another and the bigger the gains are the bigger the problem becomes.

The distribution of gains is determined by the bargaining power of the companies involved. The bargaining power on the other hand can come from multiple sources. It could come from operational excellence as suggested by neo-classical theories, it may stem from controlling a crucial asset as suggested by transaction cost economics or it can come from dominance in one of the product markets the company is involved in. All of these situations can be described through the options or alternatives available to each party. Bargaining power is in essence a good selection of alternative courses of action whereas lack of bargaining power is in essence the same as lack of good alternatives.

When two companies choose to merge, the common wisdom suggests that it is the target that captures the lion's share of the gains. Superficial analysis of the merger history seems to support this notion when only percentage returns of the stock are observed ignoring the size difference between the companies which would inflate the percentage returns of the smaller party. Furthermore, it is plausible that different types of mergers have different mechanisms determining the division of merger gains. For example, it is plausible that a merger motivated by empire building has different typical distribution of gains if compared to a vertical merger.

In case of vertical mergers it is obvious that there is mutual dependence of certain degree between the parties since the companies are engaged in trading. While both companies have some degree of dependency on each other this dependency can be highly asymmetric. As an extreme example consider a cigarette manufacturer and a paper mill. The relationship between the two is clearly one-way since paper is used by the cigarette manufacturer to wrap the tobacco while no cigarettes are needed to make paper. The cigarette factory needs paper to make its products and there are no substitutes for paper. Then again paper of similar grade is used in various applications across number of different industries. As a matter of fact sales to cigarette industry constitute only a small fraction of the overall sales of the paper industry. In

case these two companies decided to merge, it is likely that the less dependent party commands more bargaining power *ceteris paribus*. In other words, the paper mill would likely to have upper hand in the merger negotiations and capture greater share of the joint gains of this merger.

The primary goal of this thesis is to investigate does the asymmetry in the intensity of the customer-supplier relationship in product markets as described above transfer into bargaining power when a company chooses to buy its supplier or customer and bring the transaction from external markets to internal markets. Measuring this kind of asymmetry is not entirely straightforward with any single variable. However, measuring how big customer the customer is to the supplier and how important is the supplier to the customer in producing its final output is a good proxy. Although it does not necessarily reflect the substitutability of inputs it none the less reflects the scale of involvement of the both parties.

If asymmetric mutual dependency does in fact create bargaining power for either of the players, then it has to be reflected in the outcome of the negotiations. The party that has upper hand in the negotiations should be able to extract more value for himself from the merger than the other party. Unfortunately, the mere price paid tells us very little as there are many other factors affecting the outcome of the negotiations. However, we need not necessarily to analyze the favorability of a contract ourselves. If both the target and the acquirer are publically traded companies and if we further more assume that the financial markets are semi-strongly efficient, by observing the stock market reaction to the merger announcement we are able to extract information about the outcome of the merger negotiations. Assuming that all previous relevant information is already incorporated to the stock price and that no new information irrelevant<sup>19</sup> to net present value of the merger is not revealed as a result of the deal, the aggregate stock market reaction should only reflect the value creation (or destruction) of the deal multiplied by the probability of the deal going through as it is.

Since completion of the merger requires the approval from both companies, the actual probability of merger succeeding does not affect the euro denominated distribution of how the value created or destroyed by the merger. By making assumption that managers are at least as

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<sup>19</sup> Irrelevant to the merger NPV refers to new information that would reflect information that would impact the company even if the merger does not go through. This would for example information such as the competency of the companies' executives.

rational and well informed as the market, the acquirer will not pass an offer that it thinks is not acceptable to the other company where as the target will not accept a deal that the market thinks is unfair. From these assumptions it follows that the market reaction to the first merger announcement should reflect the value distribution outcome of the proposed deal irrespective if the deal passes or fails and for this reason we need not to limit ourselves merely to completed transactions.

At the moment the European Union is the largest single market in the world surpassing that of the United States. In terms of variety in economic activities the EU is almost as diverse as the US. For these reasons studying how product market dependencies affect bargaining outcomes in the EU economy offers a large and balanced sample of companies in multiple industries. However, although the Union has gone through unprecedented expansion and integration over the course of the past 20 years, large cultural and linguistic barriers still exist. This makes it interesting comparison to Ahern's (2012) work which studies this question in the United States, a country culturally and linguistically much more integrated than the EU. I follow Ahern's footsteps and investigate the same question with corresponding European data to see if his results hold also for Europe.

For technical and clarity reasons the sample is divided into smaller subsamples along the following lines: backwards and forward vertical mergers as well as all mergers and positive net gains subsamples. Next I will briefly go through the mathematical formulation of the study and its key parameters.

In essence, to conduct the study we need to observe the co-variation of the distribution of merger gains between the target and the acquirer and the relevant sources of bargaining power. The net gains from merger can be calculated using the following equation:

(1)

$$PVS_{AT} = PV_{AT} - (PV_A + PV_T)$$

where

*PVS<sub>AT</sub>* = net present value of gains brought by a merger to the acquirer and the target

*PV<sub>AT</sub>* = net present value of the combined entity's equity after the merger announcement

*PV<sub>A</sub>* = net present value of the acquirer's equity before the merger announcement

*PV<sub>T</sub>* = net present value of the target's equity before merger announcement

In the study I use two different measures for division of gain between the target and the acquirer both of which are more closely explained in Section 4.2.1. The first measure is meant for samples of all mergers whereas the second is used in the positive gains subsample. The reason for using two different measures is because when either party has negative returns, thinking about division of gains as a pie to be split makes no sense. So for time being I shall only refer to  $\Delta\$CAR$  as the indicator of division of gains.

Next we also need to define the variables of interest that proxy bargaining power arising from asymmetric vertical relations. For this purpose I use two variables which are properly defined in Section 4.2.2.2 but for now I only refer them as RSI and RBI.<sup>20</sup> The first one proxies the bargaining power of the supplier and the latter the bargaining power of the customer. Naturally there are plenty of other variables that have been demonstrated to have impact on bargaining outcome such as method of payment, however for now I refer them only as other variables and they are collectively denoted as  $\vartheta$ . The following equation summarizes what has been said above.

(2)

$$\Delta\$CAR = f(RSI, RBI, \vartheta)$$

where

$\Delta\$CAR$  = *measure of division of gains*

$RSI$  = *relative supplier importance*

$RBI$  = *relative buyer importance*

$\vartheta$  = *other variables*

In other words, the distribution of gains is a function of RSI, RBI and other variables. This study investigates if RSI and RBI are one way or another related to division of gains as measured by  $\Delta\$CAR$ . If there is a statistically significant relationship I expect the sign of RSI and RBI to depend on the selected subsample. This is because the dependent variables are calculated as target's share of the total gains. When the supplier is the target, the RSI, which proxies supplier's bargaining power, should have positive coefficient. This is reversed when supplier is the acquirer and greater gains to supplier mean smaller gains to the target.

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<sup>20</sup> RSI stands for Relative Supplier Importance and RBI for relative Buyer Importance.



Analogously, the RBI is expected to have positive coefficient when the customer company is the target and negative when it is the acquirer.

## 4 DATA AND METHODOLOGY

It is a blatant banality to state that any model is only as good as the input used in it but the importance of appropriate sample data selection cannot be stressed enough. Disturbingly high number of studies and analysis recently presented in the media has been based on dubious data or questionable methodology used to analyze that data. From society's point of view this is dangerous if policies are based on poorly conducted research. From this thesis point of view, poor data and incorrect methods are equally dangerous as with larger societal perspective.

In this chapter I will explain from where and how the data are sourced, processed and used. I have attempted to include as much relevant metadata as possible to justify that the sample used is sufficiently unbiased. However, due to large amount of metadata, only a fraction of it is presented here. The rest is either left out from this thesis or included in the appendix without detailed analysis. Also presented in this chapter are the methodologies used and the justification of their use. The use of alternative methodologies is discussed as well as the potential impact for using them. I have made it my priority to justify my choices as convincingly as possible since choice of methodology could in some cases crucially affect the results. While the results of this study are unlikely to have any kind of relevance to the policymakers, I am very much attracted to the ideal of obtaining as "true" knowledge as possible.

The chapter is organized as follows. In the first part the data collection and processing are explained and analyzed. The second part is devoted to methodological issues. In the third part I explain the use of event study methodology in this study.

### 4.1 DATA

In this section I first discuss the sources of data and how it was processed. Then I proceed to critically evaluate the potential biasedness in the data.

#### 4.1.1 DATA SOURCES

This study draws its data from multiple public and private databases. Data on mergers is from SDC International Merger Database while the market and financial data are from Thomson One Banker. To be included in the final sample the merger had to be announced between 1.1.1990 and 1.6.2012 and the acquirer and the target had to have domicile and be publically

listed in Switzerland, Norway or one of the EU15 countries<sup>21</sup>. The acquirer may not own more than 50% of the target's shares prior the announcement and must seek to own more than 50% after the transaction. Finally both the target and the acquirer had to have the necessary financial and market data for constructing regression variables available from around the announcement date in Thomson One Banker database.

The reader may wonder why are not all European Union countries included in the sample while two non-EU members are – and with a good reason. Leaving out some countries could leave out part of the economic diversity which would add to the robustness of the results. However, in practice reality certain practical and theoretical issues complicate it. The main reason for this is data availability: SDC does not have many observations from the new EU members, such as the Baltic countries or the Eastern European<sup>22</sup> countries. On the other hand, there are two highly developed countries with good coverage in SDC that are not EU members but are nevertheless strongly integrated to the European economy, namely Norway and Switzerland. For this reason I decided to include the only the EU15 and two EFTA members, Norway and Switzerland. I also considered inclusion of Iceland but due to its relatively small economy and industry base as well as its abnormal ventures in banking and finance related mergers in the late 2000s I decided to exclude it.

The requirements for pre and post-announcement ownership were included to make sure that only transaction where the control of the target company changes hands if the deal succeeds. Without the restriction the database would have returned also transaction where only a stake in a company was acquired. However, the completion of the deal is not a requirement and thus the sample includes also withdrawn and pending transactions. The reason for this is that I am interested in the perceived synergies in the vertical integration and not realized synergies.

Choice of time frame was affected by two contrasting needs. While the primary interest is in understanding the prevailing situation, using just a few years of data would likely to yield sample sizes too small. Then again data availability was severely restricted before the early 1990s. Since according to SDC's supporting notes, their data collection in Europe started only

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<sup>21</sup> EU15 countries consist of the following countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Ireland, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom

<sup>22</sup> Furthermore, it is questionable if the industrial structure and development of those countries matches that of the western European countries or the USA too

in 1984, it seems likely that number of early observations were not recorded. Furthermore the availability of the market data is also more restricted beyond that date. Therefore as a reasonable compromise I decided to draw the sample from mergers, acquisitions and asset purchases that were announced between 1.1.1990 and 1.6.2012.

Restriction on availability of market and financial data for both the target and the acquirer is set because without complete, data running the regressions would not be possible. The daily stock market return data along with number of control variables are obtained from Thomson One Banker using a set of inter-database identifiers provided by SDC. Results obtained are validated manually to make sure that the identifier actually returns the same company name as SDC gives. Once this is done the results from different identifiers are consolidated and collected into a database for further use.

With these restrictions the final sample consists of 815 merger announcements from 1990 to mid-2012. The sample was primarily shrunk by the unavailability or low quality of data from Thomson One Banker. This issue is more thoroughly explained in Appendix A.

In addition to the merger and financial data, I need to first identify potential for vertical relation and then measure the intensity of that potential. For both purposes I use the Make and Use tables of the Benchmark Input-Output Accounts for year 2002 as prepared by the US Bureau of Economic Analysis. More careful explanation of what are I/O accounts and why their use is justified is found in Section 4.2.2.1. Lastly, the data on market concentration on different industries are from the Economic Census conducted by the US Census Bureau.

#### 4.1.2 **BIASEDNESS AND REPRESENTATIVENESS**

To draw inferences from the sample requires that the sample is unbiased and representative of the population. In theory, this boils down to a question: did every observation have equal chance to be included in the sample? As SDC is not a complete database, biases in the collection of the information can bias the sample. In this case there are three major potential sources of selection bias present in the data collection: nationality, time period and company size. Nationality bias arises when information collector focuses more on countries where the information is more easily accessible or which are deemed more important economies to follow such as the UK, France, Germany and Italy. Time period bias arises if in some years larger fraction of mergers is included in the sample than other years and there are differences between different years. Finally company size can affect if data about the company is added

to the data base. Focusing on these sources of potential bias I will next assess the likely extent the biases in the sample.

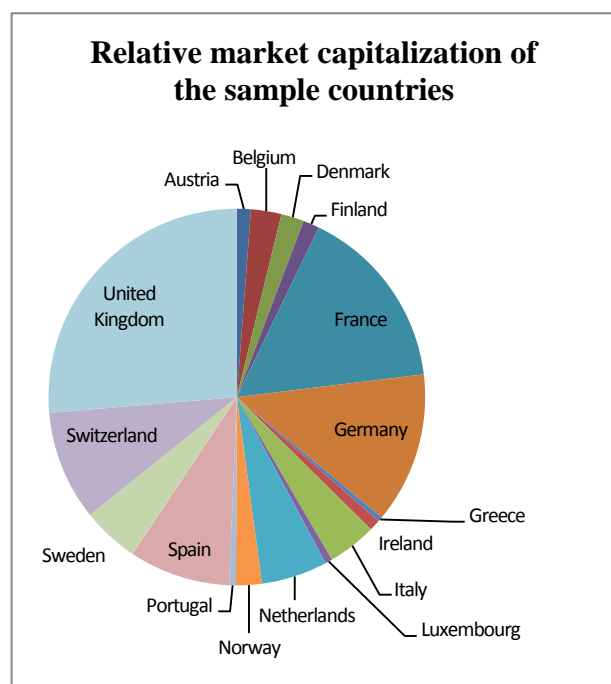
**Table 1: Proportion of mergers by country compared to the country's relative size of equity markets**

Country	Relative size of equity markets	Mergers by SDC	Mergers in final sample
Austria	0.9 %	1.0 %	1.4 %
Belgium	2.0 %	1.5 %	0.9 %
Denmark	1.5 %	2.5 %	1.3 %
Finland	1.1 %	1.6 %	1.5 %
France	12.3 %	12.5 %	4.1 %
Germany	10.1 %	7.3 %	11.0 %
Greece	0.3 %	1.9 %	5.6 %
Ireland	0.7 %	1.4 %	1.0 %
Italy	3.3 %	4.8 %	11.2 %
Luxembourg	0.5 %	0.4 %	0.0 %
Netherlands	4.4 %	3.5 %	3.3 %
Norway	1.7 %	3.3 %	7.1 %
Portugal	0.4 %	0.8 %	2.3 %
Spain	6.7 %	3.5 %	6.8 %
Sweden	3.8 %	6.9 %	9.5 %
Switzerland	7.3 %	3.6 %	3.6 %
United Kingdom	20.5 %	43.4 %	29.4 %

As I was unable to find year by year statistic of actual merger transactions across countries I assess the potential nationality bias by looking at the relative sizes of the market capitalization of the countries included in my sample. I then compare this figure to the SDC's distribution of mergers. I am aware that size of the stock market does not equal merger activity as but it is an easy and intuitive back of the envelope check in absence of better information. The first

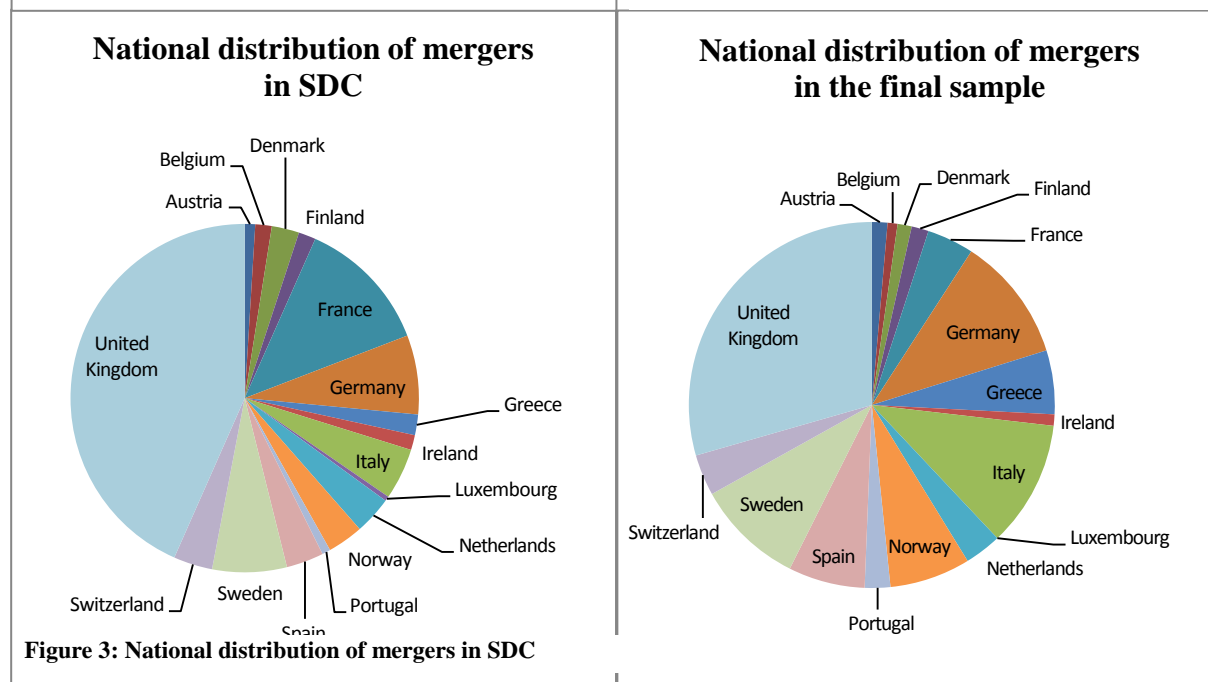
column of Table 1 shows the relative

**Figure 2: Relative market capitalization of sample countries**



sizes of equity markets at the end of 2012 within the sample countries while the second column indicates the proportion of mergers where at least one party is from the listed country according to SDC.<sup>23</sup> The third column indicates the actual number of mergers that were included in the sample after all data criteria are implemented leaving total of 798 mergers in the final sample. The same information is graphically presented in Figures 1-3.

**Figure 1: National distribution of mergers in final sample**

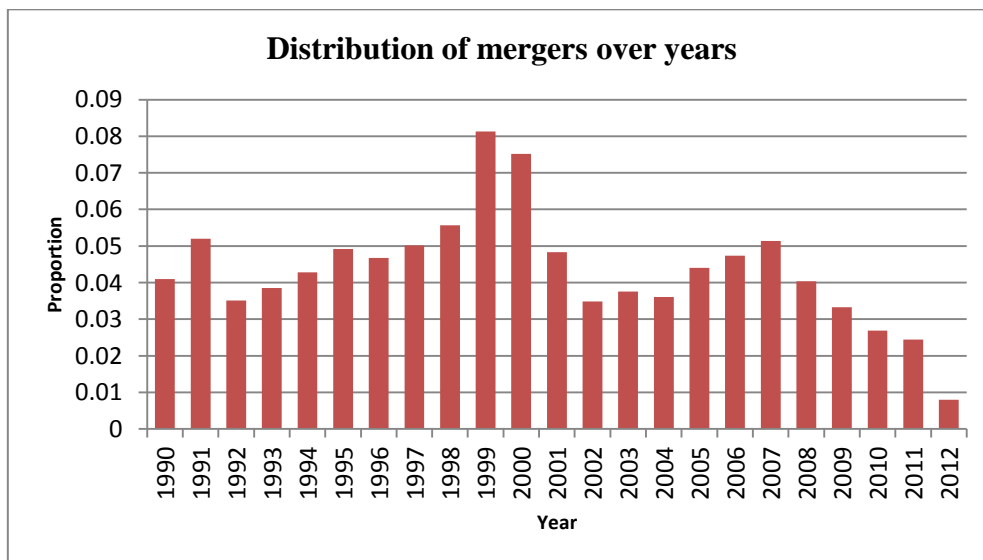


**Figure 3: National distribution of mergers in SDC**

<sup>23</sup> Source: <http://www.quandl.com/economics/stock-market-capitalization-all-countries> retrieved 6.5.2013.

Generally the share of mergers corresponds quite well with the relative size of the equity market although there are few notable exceptions. The UK clearly dominates in the share of mergers but this is not surprising considering that UK has far less regulated equity markets than most European countries. All in all it appears unlikely that there is nationality bias in the SDC database. When looking at the final sample used in the study reveals a few anomalies that arise from imposing the data restrictions. The relative shares of the UK and France fall sharply while relative shares of Italy and Norway more than double. Luxembourg is completely eliminated from the sample. Closer inspection reveals that availability of one of the four accounting data items explains most of the elimination. It is likely that this will slightly bias the sample towards larger companies and more recent observations as most of the missing data is from the early years and it is conceivable that large companies are more likely to have their accounting data included in the database.

There is evidence that some mergers are missing from the early years. For example, for the boom year 1985 the database records only 27 mergers throughout the sample of 17 countries. In comparison the data suggest that the year 1990 saw 161 mergers. It seems unlikely that such growth has happened in reality. It is difficult to say how severely this affects the sample as my data collection for this reason starts from year 1990. However, it is likely that small mergers are more likely to be excluded from the sample than large ones.



**Figure 4: Distribution of mergers in time.** This figure shows that there is no unusual clustering in the mergers in time.

While the sample has is not entirely unbiased, it is unlikely that these issues would seriously bias the sample since all the major European economies have representation, none of the

countries is dominating the sample and the merger activity is distributed as roughly expected across the sample time period. It seems unlikely that any of the issues listed above would influence the outcome of the study one way or another.

## **4.2 METHODOLOGICAL CONCEPTS**

Results of any study are not only heavily dependent on the sample used but also on methodology used. For this reason careful consideration has to be given also to the choice of methods used. In this section I am going to explain my methodological choices and how do they compare to other similar studies. All procedures used in this research are described in detail sufficient enough to permit accurate replication of the study.

This study uses the event study methodology in combination with OLS regressions. Both methods are widely employed in studies similar to mine. They are theoretically and empirically robust and permit the assessment of the results with various statistical tools. I will first explain the regression equation and its variables and then explain merger classification. The event study methodology is explained at the end of this chapter.

### **4.2.1 MEASURES OF THE DIVISION OF GAINS**

The first step in defining the regression models is to define the dependent variable. In this case it is a measure for division of gains. The merger outcome in terms of gains is measured using the sum of the acquirer's and target's abnormal euro returns surrounding the announcement of the deal. Measuring only the cumulative abnormal returns (CAR) is not enough since often the merging companies are not equal in size. Due to this difference using only the percentage returns would give misleading picture of the actual distribution of the merger gains. To be more concrete, imagine two companies A and B that are negotiating a merger. Suppose that the net present value of the mutually perceived combined gains of the merger total 5 euros. Furthermore, let us assume that the pre-merger market value of company A is 100 and the market value of the company B is 10. If A makes a bid of 12 for company B and B accepts, the rational market reaction to the announcement is that the market value of A should become 103 ( $100 + 10 + 5 - 12 = 103$ ) and the market value of company B should increase to 12. In percentage terms A gains 3% while B gains 20%. Looking only at the percentage gains it looks like the target (B) captures bulk of the merger gains. However, the tables are turned if we investigate the division of the merger gains in euro denomination. Total gains is 5 of which A captures 3 or  $3/5 = 60\%$  while B gets only 40%. Since I am interested how the dependent variables effect the bargaining outcomes (which should on



average reflect bargaining power), it is more appropriate to observe the euro-weighted distribution of the gains rather than a measure based on the percentage gains.

To measure division of gains, ideally I would like to measure the target's percentage share of the total gains. In principle this is fairly straightforward, it is like splitting a "pie of gains". However, this analogy breaks down if either or both of the parties have negative returns. In these cases I cannot simply divide the share of acquirer's or target's euro returns by the sum of the returns. To circumvent this problem, I calculate the division of the abnormal returns by taking the difference of the target's abnormal euro returns and subtract the acquirer's abnormal euro returns from it. To normalize the results for regression, I divide the difference by the combined market cap of the two companies 50 days before the announcement of the merger. This measure represents the relative gain of the target vs. the acquirer for each euro of total market value and I denote it by  $\Delta\$CAR$  throughout this paper. For mathematical formulation of this idea, see Equation 3 below. I will also identify a subsample of mergers where both the target and the acquirer have positive returns and will use the more intuitive "pie splitting" approach there. How all this is done in detail is explained in the Section 4.3.

(3)

$$\Delta\$CAR = \frac{\$CAR_T - \$CAR_A}{MVE_A + MVE_T}$$

where

$\$CAR_A$  = cumulative euro abnormal return of the acquirer

$\$CAR_T$  = cumulative euro abnormal return of the target

$MVE_A$  = market value of equity of the acquirer

$MVE_T$  = market value of equity of the target

The interpretation for this variable is following. Value zero indicates equal distribution of dollar gains or losses. Positive values indicate that target has gained more while negative values indicate that the acquirer gained more. The variable lacks everyday meaningful economic interpretation but it can be thought as how many cents the target gains more than the acquirer per each euro of combined market value of the two companies. The great advantage of this way of measuring division is that it can also deal with negative euro returns consistently.

#### 4.2.2 MEASURES OF INDUSTRIAL RELATEDNESS

To test the hypothesis that customer-supplier relationships influence the division of gains in mergers I have first classify each merger. That is to identify each merger either as horizontal, vertical forward, vertical backward, vertical indeterminate or conglomerate. Correctly classifying mergers with significant vertical integration potential is not an easy task. Theoretically correct way of doing this is to go through every transaction and assess if actual vertical trading or potential for vertical trading exists. However, this is a very labor intensive way and not entirely without problems. Therefore an alternative way is needed for tracking industrial relations and classifying mergers.

Previous studies have relied on SIC/NAICS codes to detect relatedness between the acquirer and the target. While fairly good at detecting horizontal mergers, this measure is inaccurate and unsatisfactory for finding vertical mergers because SIC and NAICS classify industries based on similarity of output (SIC) or similarity of production process (NAICS) rather than vertical relations. For example oil exploration, extraction, refining and retail sales are all clearly and unquestionably vertically related. However, in NAICS and SIC most of the different stages of the final product (refined gasoline) are fall under different 2-digit SIC and NAICS codes. For example, under NAICS (2012) “Crude petroleum and natural gas extraction” industry falls under code 211111, “Drilling oil and gas wells” under 213111, “Oil and gas pipeline and related structures construction” 237120, “Petroleum refineries” under 324110 and “Gasoline stations” under 447110. While it is clear that all of these activities are vertically related and essential components of the supply chain, it would be impossible to identify using just NAICS codes alone. Other studies have used laborious manual inspection to identify supplier-customer relationships, for example one of Fee and Thomas (2004) that investigates the impact of horizontal mergers on vertical trading partners.

However, another way exists around this problem. Customer-supplier relations are essentially exchanges of commodities or services for money. Tracking these flows of the company and its competitors would serve as an excellent proxy for detecting vertical integration or potential for it. It turns out that data very similar to this do exist. Various countries collect information on commodity flows in the economy on an aggregate level, typically by macro-industry. This information is collected into so called Input-Output (or just “I/O”) tables which are very useful in conducting number of different economic analyses. In essence, I/O tables track down the flow of raw materials and intermediate goods as they flow through the economy to the final users i.e. to consumers or to exports. Number of countries collect and publish

different kinds of I/O data that are publically available to anyone, however, the standards and detail of such data vary greatly.

#### ***4.2.2.1 USING INPUT-OUTPUT TABLES***

The Input-Output tables are a collection of different matrices that track the flow of goods and money as they flow through the economy. The exact components of each I/O set varies between countries but the main components are the “Make” or “Supply” table and the “Use” table. In addition, the I/O set often include various supplements which detail the material flows or trade. The make table effectively tells what goods different industries produce and what is their monetary value. The use table on the other hand lists all the goods produced in the economy and which industries use them and their monetary value. For more detailed description of the Make and Use tables see Appendix B.

It is very important to realize at this stage that the Make and Use tables do not give information about who is using whose products. Even if industry A produces commodity Z and the industry B uses commodity Z it does not mean that industry A and B actually trade certain amount of commodity Z. It is very much possible that industry A exports all of its output while industry B gets its input from industry C who is a secondary producer of Z. For this reason using the I/O analysis measures the potential for vertical trade on the industry level – not actual trade. Even if we could deduce that industry A and B actually traded, we could not guarantee that company 1 belonging to industry A and company 2 belonging to industry B trade in real life. However, we can say with high degree of confidence that potential for vertical trade between company A and B does exist.

In combination the Make and Use tables can be used to build a model of a supply chain, or actually more accurately, a supply web. From that model we can construct two simple measures that can be used determine direction of the supplier-customer relationship and to proxy the intensity or importance of the product market relationship. However, before venturing into that an important decision must be made. Since most industries produce secondary commodities in addition to their primary product we must make decision should we track all commodities produced by the supplier or only the main product? The advantage of including more than just the primary product is that it can better find relations which happen at the secondary product level. However, this comes at a cost. It is likely to introduce a lot of noise as well since some goods are produced by multiple industries but that those goods are traded within that industry. For example most manufacturing industries also

produce specialized computer software which is listed on the Make table. Computer software in industrial setting is very specific product and it is unlikely that such products are very useful outside the industry itself. Since specialized computer software is used in many industries it would be more than likely to find “potential” links that do not in real life exist. Suppose a merger between insurance company and a pulp mill. Although it is obvious that such merger would be conglomerate, this system would indicate that it has vertical component via specialized computer software that in reality does not exist. There are ways to address this problem such as ignoring product categories that are so vague that would permit formation of arbitrary links or giving weights to the importance of production. However, both measures require considerable subjective judging on what products to drop or what should be the threshold for considering a weighted figure significant enough. For these reasons I opt for tracking just the primary product.

#### **4.2.2.2 CONSTRUCTING VARIABLES OF INTEREST**

In this study I am using the I/O tables of the United States economy provided by the US Bureau of Economic Analysis. The reader may be puzzled by this choice; after all, the rest of the data are from Europe. The main reason is of course lack of suitable data from Europe; however, using US data should not affect the results. This is further discussed in the Section 4.2.4. In the following subsections I will explain the two main explanatory variables I construct to measure the intensity of the customer-supplier relationship.

The starting point is to convert the NAICS<sup>24</sup> codes provided by SDC to the corresponding I/O codes using concordance table by BEA. Then following Ahern (2012) and Fan et. Goyal (2006) I construct *Relative Supplier Importance* score (RSI) and *Relative Buyer Importance* score (RBI) to proxy the mutual dependency of the two companies. RSI measures the customer’s dependency on the supplier and it is calculated by taking the dollar amount of purchases of the customer from the supplier and dividing it by the total production output value of the customer. In other words RSI is the fraction of the input from the supplier that the customer requires to produce one dollar worth of output.

(4)

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<sup>24</sup> NAICS stands for “North American Industry Classification System” and it was designed to be the successor to the SIC system.

$$RSI = \frac{\text{Customer's purchases from the supplier}}{\text{Total output of the customer}}$$

RBI on the other hand measures the supplier industry's dependency on the customer industry. It is calculated as the dollar amount of the output sold by the supplier industry to the customer industry divided by the total dollar output of the supplier industry. In plain English this is the fraction of the production bought by the customer from the supplier assuming that the customer bought its entire demand from the supplier and did not import anything or buy the good from a secondary producer. Because in practice most goods have number of secondary producers and the goods could also be imported, the value of RBI may exceed 100%.

(5)

$$RBI = \frac{\text{Customer's purchases from supplier}}{\text{Supplier's total output}}$$

To make the comprehension of these two measures easier, an example is in order. If the total production of Industry C (customer) is \$50bn and it buys \$10bn of industry A's (supplier) output then the RSI is \$10bn/\$50bn = 0.2 as shown in Figure 5.

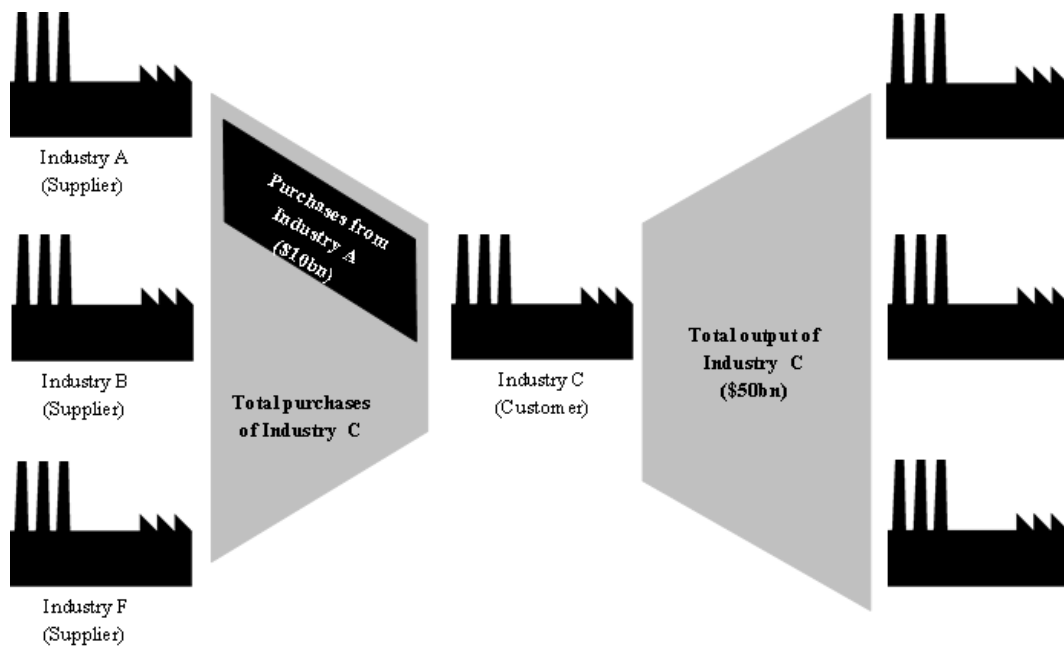
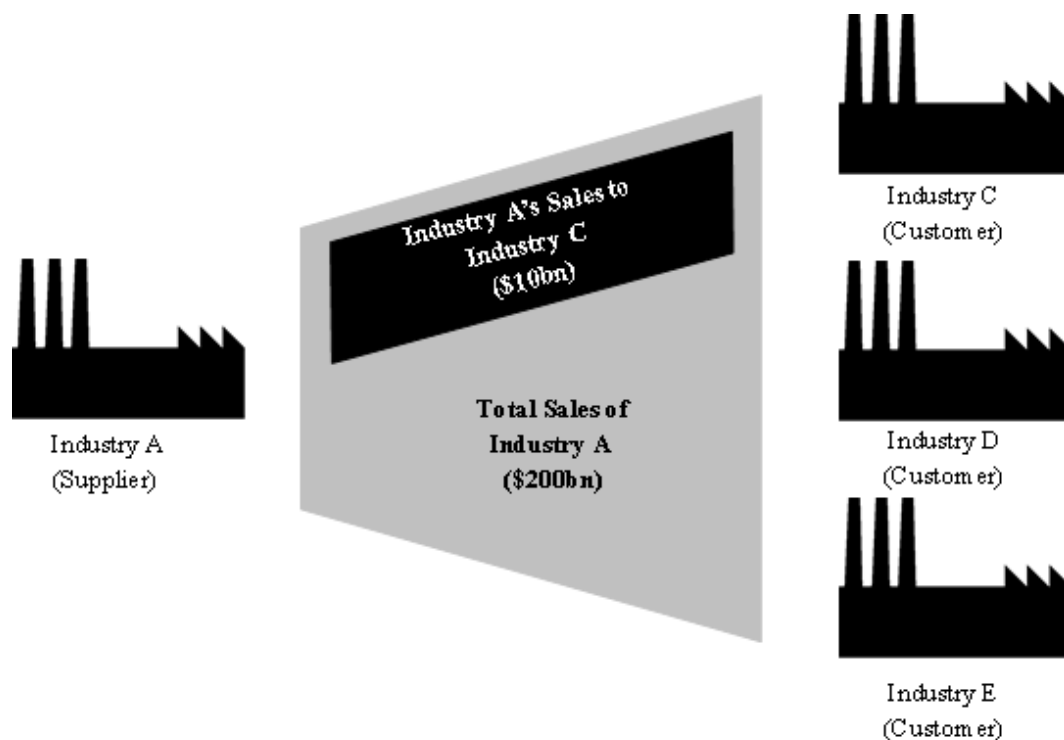


Figure 5: RSI explained

Then again if the total production of Industry A is \$200bn then the RBI is  $\$10\text{bn}/\$200\text{bn} = 0.05$  as demonstrated in Figure 6.



**Figure 6: RBI explained**

The real world interpretation of these numbers is as follows. RSI of 0.2 tells that in to produce \$1 of output Industry C requires 20 cents of input from Industry A. The RBI value on the other hand tells how much of Industry A's production is used by Industry C assuming Industry C buys all of its input from Industry A. So in this case 5% of Industry A's production has the potential to be sold to the Industry C.

It is also important to realize that RBI and RSI capture merely industry wide trading transactions and as such they say nothing about relationship specific assets or special circumstances discussed in sections 2.2.2.2.2 and 2.2.2.2.4 concerning TCE and PRT. However, since positive non-zero values of RSI and RBI are prerequisite for a relationship implied by both TCE and PRT, then using them will include mergers relevant to TCE and PRC although it cannot distinguish them from the rest.

In my study I am using the year 2002 Benchmark Accounts. The reason for using a one year's accounts instead of matching the transaction with the corresponding year is dictated by

several reasons. First and most obvious one is that the benchmark accounts are produced only every five years and the most recent published one is year 2002 as the 2005 accounts are not published yet. Previous benchmark accounts that fall on my chosen time frame are 1997 and 1992 but the use of only 2002 is preferred for the following reasons: 2002 splits my chosen time frame roughly in half, the 2002 already reasonably reflects the rise of IT industries at the turn of the millennia and the previous accounts do not use classification system consistent with each other's. The use of single year accounts is likely to bias the results against finding a meaningful relationship since it has the potential of inducing noise to the sample.

Because it is not immediately obvious which company is the supplier and which the customer without manually checking it, I have to calculate the RSI and RBI values for each transaction twice: in the first case assuming the acquirer is the supplier and in the second case assuming the acquirer is the customer. These two values are then used to determine the type of the vertical relationship (backward, forward and indeterminate) in the Section 4.2.3.

#### 4.2.3 MERGER CLASSIFICATION

After obtaining and calculating the necessary variables it is time to classify the mergers in the sample and sort them into appropriate subsamples, namely horizontal, vertical backward, vertical forwards, vertical indeterminate and conglomerate mergers. The forward and backward mergers are self-evident but the reader may wonder what is meant by indeterminate vertical merger. This class of mergers arises because in real world some industries do not have ambiguous "direction"<sup>25</sup> in flow of goods and it is those mergers that are to be classified into the vertical indeterminate group. Also, some vertical mergers are likely to have horizontal components and vice versa.

In this thesis I am focusing on "pure" vertical mergers as the magnitude of the phenomenon I am studying is likely to be very low and introducing mixed merger types to the subsamples is likely to add noise to the results. For this reason the starting point of my classification is to first identify horizontal mergers and only then go through the remaining mergers looking for vertical relationship. Finally, once the vertical mergers have been identified and classified, the reminder of the sample is classified as conglomerate mergers. In the following sections I am going to explain how this was done.

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<sup>25</sup> If an insurance company buys a bank, it is hard to say which one is the supplier and which one is the customer since they both use banking and insurance services.

#### 4.2.3.1 IDENTIFYING HORIZONTAL MERGERS

The standard approach in identifying horizontal mergers has been the use of SIC or more recently NAICS codes<sup>26</sup>. Typically the author of a study chooses a level of detail, say two, three or four first digits of the companies SIC or NAICS code and then checks if they match for the both companies. In principle any level of accuracy could be chosen and choosing more digits will make the horizontality criteria stricter. However, often it is not desirable to use five or six digit NAICS as that would classify a merger horizontal only if both the companies operated exactly in the same industry. In this study I use six-digit I/O code that roughly corresponds to a four-digit NAICS code.<sup>27</sup> I compare the I/O codes of the acquirer and the target and if they are the same, the merger is considered to be horizontal. I do not wish to implement too harsh criteria on horizontal mergers since a merger of companies serving the same customer group could have entirely different solutions and offerings. For this reason I use the 6-digit I/O code as it gives flexibility in identifying vertical mergers. However, in unreported tabulation I find that using 4-digit NAICS codes instead does not significantly change the classification results.

#### 4.2.3.2 IDENTIFYING VERTICAL MERGERS

The next step is to go through the remaining mergers and identify them as backward, forward or indeterminate. This is done based on the RBI and RSI values. A backward (forward) merger is a merger where the acquirer (target) buys more from the target (acquirer) than the target (acquirer) buys from the acquirer (target) and the target (acquirer) supplies more to the acquirer (target) than the acquirer supplies the target in terms of RSI and RBI values.

(6)

*For backward merger it holds true that*  $\begin{cases} RBI_A > RBI_T \\ RSI_A < RSI_T \end{cases}$

*For forward merger it holds true that*  $\begin{cases} RBI_A < RBI_T \\ RSI_A > RSI_T \end{cases}$

where

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<sup>26</sup> For example see Chattarjee (1986) and Sudarsanam (1996)

<sup>27</sup> For more information about the six-digit I/O coding system see Lawson (1997a). For comparison, I/O coding has roughly 400 entries whereas four-digit NAICS has roughly 300 entries.



$RBI_A$  = relative buyer importance assuming acquirer is the customer

$RBI_T$  = relative buyer importance assuming target is the customer

$RSI_A$  = relative supplier importance assuming acquirer is the supplier

$RSI_T$  = relative supplier importance assuming the target is the supplier

Note that this definition rules out the possibility of indeterminate vertical relationships where only one of the two mathematical conditions are met. The rest of the mergers with vertical component but indeterminate customer-supplier relationship are classified as indeterminate vertical mergers. The remaining mergers that do not fall into any of the previous categories are classified as pure conglomerate mergers. See the table below for the distribution of different merger types.

Now the necessary work from the I/O tables is done and the data collected are merged with the market data in a database I constructed for this purpose. The RSI and RBI will be used in the regressions as the main variables of interest. In the next section I will discuss some problems and challenges associated with the I/O framework as well as justifying why using the US data on European markets should not largely matter.

#### 4.2.4 THE CASE FOR USING THE US DATA

A reader might now wonder how valid could it be to use a US dataset in Europe. After all, those are two different geographical areas and completely separate administrative regions. If I/O information is so widely used across the industrialized world, why would I not use European data? Unfortunately, no unified I/O dataset with sufficient level of detail exists for the European Union. Tables produced by the Eurostat are not detailed enough for meaningful analysis of this sort as they track down commodities and industries with detail of some dozens industries and commodities. While some European countries, such as the UK and Germany, do produce their own national I/O data with great detail, processing and combining the data from these multiple sources would be unfeasible. It would take years of work even from the Eurostat to produce that information, and yet it would yield only a marginally more accurate picture at best.

The most comprehensive and readily available I/O dataset is the Benchmark Input-Output Accounts prepared by the United States Bureau of Economic Analysis (BEA). It is a combination of multiple complementary sources such as the Economic Census, the Internal Revenue Service and the Bureau of Labor yielding a rich and detailed picture of the material

flows in the US economy. The Benchmark Accounts are prepared every five years and together form a dataset that track the annual commodity input and output flows in the US economy. Despite the wealth of information in presented in the various tables I am only going to use for the purposes of this study two of them: the “Make” and “Use” tables. These tables distinguish between over 400 different industries and commodities classified by unique I/O code which neatly corresponds roughly to 4-digit NAICS codes (Ann M Lawson 1997a, Ann M Lawson 1997b).

Before proceeding I feel the need to address potential concerns that could arise from using the US data. Although the European Union and the United States are roughly equal in size when measured by GDP, there could be differences in absolute and relative sizes of the different industries. While this is probably the case, it is very unlikely to greatly affect the data that we are interested in. To first address the absolute size difference question. The data we are after is the relative shares of different commodities used and supplied by different industries to each other. Suppose vertically trading industries A and B are only half of the size in Europe as they are in the US. Assuming everything else is unchanged, this does not affect the RSI and RBI which are fractions of the input and output flows. By this I mean that for example producing 1 unit of bread requires 0.8 units of flour per 1 unit of bread irrespective of does the factory produce ten thousand units of bread or million units of bread. The question of relative size difference of industries is trickier. If significant differences existed, it would affect primarily RBI, not so much RSI. This is because if the customer industry is smaller, it will scale down its purchases in relation to its output. However, RBI does not work the same way. If the customer industry is relatively speaking smaller than the supplier industry, the RBI value diminishes.

Do we then have reasons to believe that such large relative differences should exist and are there any reasons to believe that such differences are not likely to be large? When a firm, and in a larger scale industry, makes a production and investment decisions they are affected largely affected by 4 different factors. The first factor is available production technology and it could affect the production decision in three ways. First, it could permit production of a commodity that could not otherwise be produced, such as CPUs or other high tech commodities. Most developing countries lack the production technology necessary to make such sophisticated products. Second, it could permit use of alternative input materials to make the same output. A good example is the case of fuels. Diesel and gasoline can be either extracted from crude oil in classical distillation process or converted from coal with Fischer-

Tropsch synthesis. Third, technology could allow more efficient use of raw materials reducing the consumption of one or more input materials which could alter the input coefficients of the producer. For example, fuel efficient engines and energy saving measures could mean that less fuel and electricity are needed per production unit to produce one unit of final product. Question is now, are there likely to be large differences in overall level of technology in the US and Europe. This is clearly not the case. Technology and innovations dissipate fairly quickly across the Atlantic. The internet, social and community networks and multinational corporations ensure that innovations affecting entire industries cannot be contained just to the one side of the ocean.

The second factor that could affect the commodity flows is the substitutability of inputs and their relative prices. For instance, industrial grade alcohol can be fermented from multiple different crops such sugar cane, corn, potatoes or fruits. A potential distortion could arise if, say, in the US alcohol was primarily made from corn because of its relative cheapness in the US while in Europe the primary raw material was barley or other grain crop. Using the US data would overestimate the importance of corn producers and downplay the importance of grain producers to alcohol industry. However, this is unlikely to be major concern for the purpose of this analysis as only very few products can fully substitute an input with another input from a completely different industry, in this case corn and grain producers are both under the same I/O producing industry. In any case, most traded commodities are globally traded and the prices of such commodities should be roughly the same irrespective of the country where you buy them. However, geographical differences and transport costs could cause the prices of these inputs to differ in the two markets and consequently distort the relative prices of the commodity inputs. This in turn can affect companies' production decisions in some cases. However, large geographical representation in the US and Europe is likely to average out these differences since they are expected to be regionally present in both markets.

The third factor is legislation and institutions in the country. Availability of credit and enforcement of contracts can influence industrial organization of the country which in turn could affect the investment decisions. However, broadly speaking the legal systems of Europe and the US are well developed, contracts are enforced by courts and financial systems are advanced.

All in all, since the economic and industrial structure of the US and Western Europe are fairly similar, it is reasonable to use the US tables as a proxy for measuring the industrial level bargaining power in Europe as well. Past studies suggest that industrial concentration is indeed very similar between the industrialized countries, largely because of technological factors (Simpson, Tsukui 1965). Similar language speaks studies that compare concentration ratios between countries: some small individual differences are sure to exist but all in all the US and Europe are fairly similar in terms of market structure Pryor (1972). Any deviances are likely to be small and their impact on the analysis is just to add more noise to results biasing against finding any significant relationship from the data.

Considering everything that has been said in this subsection, the use of US data is unlikely have large impact on the results and any distortion is likely to only bias against finding significant relationship rather than the other way around. Furthermore, use of the US data is likely to improve cross country comparability of my results to Ahern's results (2012) because according to Simpson and Tsukui (1965), cosmetic differences between countries in I/O tables exist but they are more of a result of different standards in reporting than actual differences in underlying relations. Use of same reporting standard as input for constructing the variables is therefore likely to improve validity of comparison between the two studies.

#### **4.2.5 LIMITATIONS OF I/O CLASSIFICATION**

To identify supplier-customer relations in the merger sample, the company NAICS codes need to be converted to I/O codes and matched in the I/O tables by finding if the industries where the companies belong to trade. Theoretically, all industries that use industry A's output are customers to the industry A and the industry A is their supplier. However, this line of thinking raises a few problems with the real life data on two issues.

The first issue is that some inputs are clearly not significant in dollar terms to likely justify an acquisition of their supplier or customer. For example, retail stores buy plastic bags from the plastic bag industry but the overall value of those purchases is very low. It seems unlikely that a merger between a retail store chain and a plastic bag maker is due to retail store wanting to secure its supply of plastic bags or plastic bag maker wanting to secure a customer.

The second problem is that some industries use output of their customers to produce their own output. For example, insurance companies buy banking services from the banks while banks buy insurance. In this case, it is unclear which one is the ultimate supplier and which one is the ultimate customer. Similar problem is present with machine tool industry and steel making

industry; they both buy the output of the other. This creates indeterminate vertical relationships where it is very difficult to say which way the relationship actually goes.

Third issue is the drawing of line between a horizontal merger and a vertical merger. In practice classification of mergers is not as clear-cut as in theory. Sometimes horizontal mergers have vertical components and vice versa. For example, suppose a gas field owner purchases an oil refiner. Most gas fields produce some amounts of crude oil that is sold to refineries as a by-product. On the other hand, the gas field operator is in business of selling energy. To certain degree natural gas and oil are each other's substitutes. Should this merger be classified as a horizontal merger with vertical component or vertical merger with horizontal component? In unreported assessment I find that significant proportion of the horizontal mergers have vertical component of some degree, sometimes even as high as 30% as measured in RSI and RBI.

Finally, the way I/O collapses industries into larger classes tends to overestimate the proportion of horizontal mergers as companies that operate in industries that are very close to each other in supply chain are classified in I/O system as the same industry. Trade between these two separate NAICS industries is in I/O system recorded as input that originates from the industry itself (auto consumption). Auto consumption means the proportion of an industry's output that is used as input to produce the output. For example, the final output of grain farming is grain seeds; however, a proportion of this output is saved and used the next year in planting the crop. Another example is "Coated and Laminated Packaging Paper and Plastics Film Manufacturing" (NAICS code 322221). This industry produces plastic wrapping that is wrapped around piled boxes to keep them together. Naturally, the output is delivered in packages that are wrapped around the same plastic produced by the factory itself. These two examples represent the genuine auto consumption. But a company that produces parts to a headlight that will be used in a car is likely to be classified into the same group as the assembler of the headlight. This relationship is not auto consumption but is counted as such in the I/O tabulation. Thus, in reality the "*auto consumption*" figures provided by the I/O tables are inflated as they mix genuine auto consumption and the production that originates from two different NAICS industries but is classified as one in I/O system. While this is a problem, its scale is likely to remain low: the example presented before is most relevant for very small companies specializing on very specific products but those same companies are most likely not public companies anyway and would not be included in this sample anyway. This issue is

not likely to significantly bias the results and any such bias is going to make finding significant results more difficult.

Now that I have gone through the most important variables in my study, namely the division of gains and the vertical dependency variables, it is time to move on to describe the event study methodology in greater detail. The rest of this chapter is dedicated to explaining what are event studies, what kind of event study I utilize and how the data collected in the event study are analyzed.

### **4.3 EVENT STUDY METHODOLOGY**

Event study methodology is probably the most utilized tool in corporate finance being in use since Fama, Fisher, Jensen and Roll (FFJR) (1969) published their classical article where they tested the stock market's reaction to stock splits. Since then it has become the statistical method of choice to assess the impact of an event to the value of the company or its rivals. The key idea of the method is that in absence of news or new information affecting the value of the company, individual stock price movements are more or less random co-movement with wider market movements. Assuming that markets are semi-strongly efficient, arrival of new information regarding the company would induce a non-random component to the stock price on the day of the event. This allows us to separate impact of the event from the "normal" or the "background noise" of the stock price movements. The event study is particularly suited for cases in which the event date can be clearly identified permitting use of short event windows. The general structure of any event study is as follows:

1. Defining event and event window
2. Estimating normal returns
3. Measuring and cumulating abnormal returns
4. Testing of results

#### **4.3.1 DEFINING EVENT AND EVENT WINDOW**

The first step in any event study is to define the event and identify the time frame (event window) when the impact of the event is presumed to be detectable. The theoretically correct event is the moment in time when the proposed merger is first publically announced. The EU law requires that the company has to release information relevant to the company's performance so that every investor has the chance to receive it at the same time. In most cases this refers to the moment in time when relevant paper work is filed to either to the relevant

authorities or the stock exchange in the country in question. For this thesis I use the announcement dates provided by SDC International Mergers database. Only the dates which are not marked to be estimates of the true date announced are included into the sample. Because it is possible that some of the information is leaked to the markets immediately before the announcement I will define the event window to start one trading day before the announcement. Because it is possible that the announcement is given on a non-trading day or after the closing of the trading on the event date, I will expand the event window to the end of the following trading day to give enough time to the markets to react to the new information. Thus the event window becomes in terms of trading days:

(7)

$$event\ window = t_{-1}, t_0, t_{+1}$$

#### 4.3.2 ESTIMATING NORMAL RETURNS

The second step is to estimate the normal returns for each stock. Multiple options exist in choice of estimation technique which can be classified either as statistical models or economic models (MacKinlay 1997). The simplest statistical method is the Constant Mean Return Model (CMRM) which is a simple statistical technique which relies on the assumption that stock price changes are normally distributed. The idea is to look for deviations sufficiently large from the expected value of the stock to detect abnormal returns. The main drawback of the approach is that it does not capture the obvious covariance between the stock and broader market. For this reason the results from CMRM have more noise in them than those that explicitly address the covariance issue. While arguably the simplest and least sophisticated method available it, perhaps surprisingly, yields almost equally good –or even better– results than more sophisticated methods (Brown, Warner 1980).

Another statistical method, which is presently perhaps the most popular one, is the Market Model approach. It is a statistical model that closely resembles the Capital Asset Pricing model (CAPM). In market model the normal return for the stock is estimated based on a univariate regression where the stock return is explained by the market return. The coefficient corresponds to the beta and intercept corresponds to risk-free rate in the CAPM. The advantage of market model is that it takes into account the covariance between the market and the stock as well as capturing the normal random variation of the stock. Disadvantage of the

method is that it is only weakly supported by economic theory and relies on a set of restrictive statistical assumptions. Furthermore, more information is required to calculate the market model estimates for the normal return than in CMRM.

In addition to already presented statistical models, a few economic models exist as well. Of those, the CAPM based approach was very popular during the 1970s. Since then considerable evidence against the validity of CAPM has mounted which has lead into CAPM falling out of favor in favor of the market model. Other economic models include the Fama and French three factor model and a model based on Arbitrage Pricing Theory by Stephen Ross. Fama and French model has seen some use in finance research, including in Ahern (2012). However, compared to the market model the three factor requires sorting of the market securities according to their size and book-to-market ratio. This makes it more data intensive than market model or CAPM (MacKinlay 1997).

For this study I have opted for using the market model due to its relative simplicity in data requirements. The three factor model was also considered but eventually abandoned since it requires far more data to be collected and processed and in the end it is not clear does it provide any clear advantages over simpler methods. In similar study Ahern (2012) found that the results of the analysis are virtually unchanged irrespective if market model or more sophisticated Fama and French model was used.

The establishment of appropriate estimation window for the normal return is the next step. The window needs to be sufficiently long to yield robust estimates, it has to be sufficiently far apart from the event date to prevent any possible pre-merger information leaks from affecting it and yet it has to be sufficiently recent to make sure the risk profile and the expected return of the stock not to change. Following Ahern (2012) I establish estimation window to start 270 calendar days before the event date and then counting forward 174 trading days. Since the sample represents a wide array of companies traded in various countries, the benchmark index used in estimation depends on the company and its listing country. Thorough list of indexes used for each country is in the Appendix C. As a main rule I either use the official general index for the stock exchange or then another index that seeks to track the market movements. The index value data were retrieved from Thomson DataStream.

I retrieve *daily compounded total return* data from the Thomson One Banker database. As the name suggests these returns are adjusted for dividends, stock splits and other factors that do not affect the value of the return for the holder but do affect the stock price. Furthermore, the



returns are not continuously compounded so I converted them from daily compounded to continuous compounding using Equation 8. The conversion into continuous compounding is done because when using compounded returns the changes of same magnitude in stock price in opposite directions do not cancel out each other. For example, -10% and 10% in consequent days do not result in net change of 0% which the average of these two numbers suggests but instead results in a net change of -1%. This problem disappears if continuously compounded returns are used.

(8)

$$R_{cc} = \ln(1 + R_d)$$

where

$R_{cc}$  = continuously compounded daily total return

$R_d$  = daily compounded total return

This conversion is done to all data that are used in this study. From now on, all return data used in the equations are continuously compounded.

The abnormal daily return is then calculated by subtracting the market model predicted normal returns from the continuously compounded actual daily returns. The returns are then cumulated as demonstrated in the following section. The cumulative excess returns of the three-day window are then multiplied by the market cap of the company at the start of the three-day window to get the returns in dollar terms.

The parameters for calculating the normal returns are estimated using the market model from the 175 trading days in the estimation window. The estimation is done running a regression in Equation 9.

(9)

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

where

$R_{it}$  = observed return for stock  $i$  for day  $t$

$\alpha_i$  = estimated intercept for market model regression for stock  $i$

$\beta_i$  = estimated coefficient for market model regression for stock  $i$

$R_{mt}$  = observed return for associated market index for stock  $i$  for day  $t$

$\varepsilon_{it}$  = error term for stock  $i$  for day  $t$

#### 4.3.3 MEASURING AND CUMULATING ABNORMAL RETURNS

Using the parameters from the market model estimation of the normal returns, the abnormal return  $AR_{it}$  for each day of the event window is calculated using Equation 10.

(10)

$$AR_{it} = \varepsilon_{it} = R_{it} - (\alpha_i + \beta_i R_{mt})$$

where

$AR_{it}$  = abnormal return for stock  $i$  for day  $t$

The abnormal returns are then cumulated over the three-day window using Equation 11 below.

(11)

$$CAR_i = \sum_{t=-1}^1 AR_{it}$$

where

$CAR_i$  = cumulative abnormal return for period  $t$  (in case of this study this is three days)

The CAR calculated this way are then used to calculate the cumulative abnormal euro return (\$CAR) according to formula below.

(12)

$$\$CAR_i = MVE_{i,t} \times e^{CAR_i}$$

where

$MVE_{i,t}$  = market value of equity of company  $i$  at time  $t$ , which in this case is the beginning of the event window

From \$CARs of both companies I calculate  $\Delta\$CAR$  as the dependent variable for the regression. Calculation for  $\Delta\$CAR$  is reproduced below for reader's convenience.

(13)

$$\Delta\$CAR = \frac{\$CAR_T - \$CAR_A}{MVE_A + MVE_T}$$

where

$\$CAR_A$  = cumulative abnormal euro return of the acquirer

$\$CAR_T$  = cumulative abnormal euro return of the target

$MVE_A$  = market value of equity of the acquirer

$MVE_T$  = market value of equity of the target

In the subsample where both companies have positive gains I use the intuitive “splitting the pie” approach for quantifying the division. See the following equation.

(14)

$$\Omega_{\%} = \frac{\$CAR_T}{\$CAR_A + \$CAR_T}$$

where

$\Omega_{\%}$  = the target’s percentage share of total gains when both companies have positive returns

I have now explained the construction of the dependent variable and the two independent variables of interest, namely RBI and RSI. Next I will introduce a set of control variables that are used or should be used in the study.

#### 4.3.4 CONTROL VARIABLES

Division of gains is likely to be determined by multiple factors rather than mere RSI and RBI which are only proxies for dependence – not dependency variables. The I/O tables measure commodity flows, not degree of dependency. Although a large volume of trade surely is an important factor creating dependency, any bargaining power arising merely from asymmetries in existing trade arrangements can be negated if suppliers and customers are easily substituted. For example, if the input is a uniform commodity traded in an exchange, finding a replacement should not be an issue. On the other hand if the input is tailor-made to the customer’s needs by a patent holder changing can be next to impossible. Unfortunately, I do not have any direct measurements of substitutability as the direct measure would require measuring the marginal rate of technical substitution between all inputs in all industries which

of course is in practice impossible. Instead I will use a set of proxies that capture different aspects of substitutability.

First, I include the price-cost margin (PCM) of both companies to account for the scarcity of the product at the company level. PCM is calculated as the sales minus the cost of goods sold (COGS) minus general and administrative costs (SGA) divided by sales.

(15)

$$PCM = \frac{Sales - COGS - SGA}{Sales}$$

If COGS or SGA are unavailable I use operating income before depreciation, interest and taxes divided by sales. Price-cost margin measures company's ability to price above marginal cost and higher values indicate larger ability to do that. While high values could indicate low substitutability it is also possible that the industry itself is capital intensive and exclusion of depreciation is the reason for the high value. I take also a similar measure on the 6-digit I/O industry level (industry profit divided by industry sales) and add it to the regression to account for scarcity of the output on the industrial level. Greater values of industry profit suggest that the industry's products do not have good substitutes and hence more difficult it is for a customer to find an alternative supplier.

Company's products might also be hard to substitute due to the heterogeneity of the product market. For example, Apple computers have products that not only command brand premium but are also difficult to switch from since they do not follow the standards prevailing in the PC industry. To take this into consideration I could compute the standard deviation within each company's industry, however, due to resource constraints I was unable to do this. Ahern used this measure in his study but found it to have small values and statistical insignificance.

Industry concentration is an alternative measure to proxy for the difficulty of changing a customer or a supplier within an industry. Industry concentration is a measure of pricing power of individual companies within an industry. It can be measured using concentration ratios which indicate how large fraction of the industry sales is concentrated to X number of companies. The US Economic Census provides concentration ratios for nearly all NAICS code industries in the US. Unfortunately similar database does not exist for Europe. Not all EU members publish such information and even those who do, often only in their own native

language. However, there are two possibilities to partially circumvent the lack of European data.

The first option is to use the US Economic Census data provided by the US Census Bureau. As with the I/O tables, the fundamental economic structure of the Western Europe and the USA is rather similar leading most likely into same kind of industry outcomes. Although comparative studies between the market structure as measured by concentration ratios are not very common, a study by Pryor (1972) suggest that industry concentration in the US and in the Europe are strikingly similar. This is not a surprising finding considering that technological and institutional factors and market size are prime drivers of industry concentration as suggested by Porter (1979). Other studies also make comparative references to the industrial concentration between the two markets among others Curry and George (1983) and Lyons et al. (2001) which suggest the same as Pryor's study. Capital intensive industries tend to be much more concentrated than labor intensive industries for the reason that large initial capital outlays constitute a barrier to entry. Europe and the US are very similar in terms of technological advancement, societal structure and institutions and thus it is hardly surprising that the industry structure between the two regions is fairly similar.

The second option is that I could use self-compiled industry concentration data from Thomson One Banker or similar database. However, the problem with that approach is that the data coverage and quality in the Thomson One Banker are likely to be poor and take considerable effort to compile at sufficient detail. Many medium to small businesses do not have their financial statements available in Thomson. Utilizing this method would therefore induce an upward bias in the market concentration calculations.

From the two approaches the first one seems to be more accurate proxy for the industry concentration in the target area. Although it has its shortcomings it is likely to be better than the alternative or nothing. Therefore, the industry concentration ratios of the acquirer and the target will be included into the analysis. The industry of the company is defined to be the first 4-digits of the company's NAICS code and the concentration ratio used is "the 8 largest firms" level. I use the concentration ratios for year 2002.

Third, companies with scarcer assets should theoretically have higher Market-to-Book ratios (M/B) which could indicate, among other things, how much bargaining power the company has. However, I am fully aware that M/B also has number of other interpretations, such as a

sign of overvaluation or growth prospects. Despite this caveat I will include it in the regression as I feel that leaving it out would be a greater evil.

There are also a set of other variables that have been found to impact returns and consequently they could also affect distribution of gains in mergers that are not directly linked to industrial relations. For ensuring that any potential results do not arise because of one these issues, as a robustness check it should be investigated if they have any impact on the results. Unfortunately, unavailability of data prevents proper checking of most of these variables but I will briefly mention some of these issues so that the reader is aware of them.

In some mergers targets set themselves a termination fee for negotiation strategy purposes. How this works is that in case they fail to consummate the merger after certain point in time they have to pay a termination fee to the acquirer as compensation. Theoretically this could lead into more aggressive bidding in competitive situations and could thus increase the bargaining power of the targets. There is some evidence to support this view (Officer 2003, Hotchkiss, Qian & Song 2005). Form of payment has been demonstrated to affect returns in mergers (Kaufman 1988). Paying with stock has been observed to be associated with lower returns compared to cash and asset payments. Although in the spirit of Modigliani and Miller (1958) form of payment should not matter in absence of taxes, bankruptcy costs, frictions and agency costs, there are other reasons which mean that form of payment can matter. For example, offering stock payment instead of cash would be preferable to management that perceives its shares overvalued. If the management has superior information compared to markets rational investors could take stock payment as a signal of overvaluation. To account for the form of payment a dummy should be included into the regression equation. However, the SDC's data on form of payment are missing for many observations and due to this was not included.

There are also other possible variables that could drive the division of gains including such as the use of merger advisers, form of payment, use of defense tactics and such things. Data availability permitting, these are included in the regressions run, however, the reliability and availability of most of these data are questionable at best.

Unlike Ahern's, my sample contains fair amount of cross-border mergers. This can have impact on the results as international mergers often involve considerable institutional, cultural and legal barriers that could mean that the subsample of international mergers has already been through an implicit self-selection. It is also possible that cognitive biases cause managers

to favor domestic companies in mergers in a similar way that has been hypothesized to happen with the equity home bias puzzle.<sup>28</sup> Based on the proportion of international mergers in my sample it is clear that domestic mergers are highly overrepresented if the relative sizes of the economies within the sample countries are used as benchmark. To account for possibility that international mergers somehow affect division of gains I add dummy variable that takes value one if the two companies are headquartered in different countries and zero otherwise.

Absolute size or size difference between the companies might also be an explanatory factor. For example, it has been observed that merger returns are affected by so called “size effect” (Moeller, Schlingemann & Stulz 2004). In practice this means that large mergers tend to fare worse than small mergers. This could also plausibly affect division of gains in mergers. Another size related variable that could be important is the size difference between the parties. The larger party could use its greater size as leverage in negotiations the same way that states use their size as leverage. To capture the impact of size I include the natural logarithms of the market values of equity of the both companies. To account for difference in size I add a relative size measure which is the market value of acquirer’s equity divided by the market value of the target’s equity.

Of all of these potential influential factors discussed above only measures of size and internationality are included in the final regressions. This was done mainly because data limitations regarding the other variables. In many cases too much data were missing, marked as unknown or there was considerable ambiguity how to include the data into the regression.<sup>29</sup> Despite these limitations I believe that exclusion of these variables is unlikely to bias the results. I base this partially on observations from previous studies. For example, in his study Ahern did not find any of the issues mentioned in this robustness checks section significant to the results. It seems unlikely that these factors would be any more important in European setting than in the US setting.

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<sup>28</sup> For more about investor equity home bias puzzle, see French and Poterba (1991).

<sup>29</sup> For example, in many cases the payment form was hybrid consisting of stock, cash and an unknown component.

#### 4.3.5 REGRESSIONS AND REGRESSION VARIABLES

Perhaps the most utilized way to investigate relationships between different variables in social sciences is to use regression analysis. In principle the specification of the actual model depends on the a priori assumptions about the form of the relationship between the dependent and independent variables. Although modern computing enables the use of both linear and non-linear models, in practice non-linear models are rarely utilized unless there are strong a priori reasons to specify a non-linear model, for example prediction by the economic theory of the form or shape of the relationship. In this case I believe that the probable relationship between RSI, RBI and  $\Delta\$CAR$  is probably non-linear which is the case with many real world phenomena. However, I cannot say is that relationship likely to be logarithmic, exponential, polynomial or something else. For this reason I opt for using the standard OLS model.

OLS regression is run to assess if the product market relationship has impact on the distribution of gains in the vertical mergers in different vertical subtypes. The dependent variable in these regressions is either  $\Delta\$CAR$  (included in all samples) or  $\Omega\%$ <sup>30</sup> (positive returns subsample). The independent variables or the variables that seek to explain the variation in the dependent variable are listed below. They include the variables of interest as well as a set of control variables. For reader's convenience the definition of each variable is included although all the variables have been defined in the preceding sections.

#### The regression equation for all samples utilizing $\Delta\$CAR$

(16)

$$\begin{aligned}\Delta\$CAR = & \alpha + \beta_1 RBI + \beta_2 RSI + \beta_3 MB_A + \beta_4 MB_T + \beta_5 P\%_A + \beta_6 P\%_T + \beta_7 \Psi_A + \beta_8 \Psi_B \\ & + \beta_9 IG\%_A + \beta_{10} IG\%_T + \beta_{11} ME_A + \beta_{12} ME_T + \beta_{13} S + \beta_{14} I + \varepsilon\end{aligned}$$

where

$\alpha$  = intercept

$RBI$  = relative supplier importance

$RSI$  = relative buyer importance

$MB$  = market to book ratio

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<sup>30</sup>  $\Omega\%$  is the target's percentage share of total gains when both companies have positive returns.



$P\%$  = price-cost margin

$\Psi_8$  = concentration ratio of 8 largest firms

$IG\%$  = industry gross margin

$ME$  = logarithm of market value of equity 50 days prior to merger announcement

$S$  = size difference between the acquirer and the target

$I$  = international dummy

$\varepsilon$  = error term

Lower index “A” indicates acquirer while “T” indicates target

**The regression equation for strictly positive returns subsample utilizing  $\Omega\%$**

(17)

$$\begin{aligned}\Omega_{\%} = & \alpha + \beta_1 RBI + \beta_2 RSI + \beta_3 MB_A + \beta_4 MB_T + \beta_5 P\%_A + \beta_6 P\%_T + \beta_7 \Psi_A + \beta_8 \Psi_B \\ & + \beta_9 IG\%_A + \beta_{10} IG\%_T + \beta_{11} ME_A + \beta_{12} ME_T + \beta_{13} S + \beta_{14} I + \varepsilon\end{aligned}$$

where

$\Omega_{\%}$  = target's percentage fraction of total gains

**Relative Buyer Importance (RBI):** This variable proxies the customer's importance to the supplier. It is counted from I/O tables using the formula below. Its economic interpretation is the customer share of the supplier's total output. Theoretical minimum value is 0% while upper limit can be higher than 100%. This is because customer industry's consumption can exceed the production capacity of the supplying industry. The shortfall is covered by imports and secondary production of other industries.

(18)

$$RBI = \frac{\text{Customer's purchases from supplier}}{\text{Supplier's total output}}$$

The expected sign of this variable depends on the direction of the vertical relationship. In forward mergers it is expected that the sign is positive. The more dependent the supplier-acquirer is of the customer-target, the more bargaining power the target has over the acquirer.

In backward mergers the relation is reversed and the sign coefficient is expected to be negative.

**Relative Supplier Importance (RSI)** This variable proxies the supplier's importance to the customer. It is calculated from the I/O tables by dividing the input from the supplier by the total output of the customer. The possible band for this variable is from 0% to 100%.

(19)

$$RSI = \frac{\text{Customer's purchases from the supplier}}{\text{Total output of the customer}}$$

The expected sign for RSI is positive for backward mergers. The more dependent the customer-acquirer is of the supplier-target, the more bargaining power the target is expected to have. In forward mergers the sign of the coefficient is reversed to negative.

**Concentration ratio of 8 largest firms ( $\Psi_{8A}$  and  $\Psi_{8T}$ )** The 8 firm concentration ratio proxies the market power of the company. More concentrated the market more difficult it is for the other party to find an alternative supplier or customer. In the regressions two variables are included: the concentration ratio for the target and the concentration ratio for the acquirer. The expected sign of target concentration ratio is positive while the target concentration ratio is negative. Concentration ratio is calculated as indicated below.

(20)

$$\Psi_{8i} = \frac{\sum_{r=1}^8 \text{turnover}_r}{\sum_{r=1}^N \text{turnover}_r}$$

$r = \text{the descending rank of a company within an industry}$

**Price-Cost Margin ( $P\%_A$  and  $P\%_T$ )** Higher PCM could indicate that a company can price above its marginal cost because its product is somehow scarce. Scarcity gives bargaining power so the expected sign of this variable is positive for the target and negative for the acquirer.

**Market-to-Book ratio ( $MB_A$  and  $MB_T$ )** The same logic that applies to market concentration applies to MB-ratio. Assuming that higher MB ratio reflected higher bargaining power, the

MB ratio of target would have positive coefficient while the acquirer's negative. However, it is important to realize that in practice M/B has multiple interpretations and the coefficient could be different for these reasons.

**Industry gross margin ( $IG\%_A$  and  $IG\%_T$ )** Industry gross margin measures the pricing power of the entire industry. Higher margins would indicate industry with pricing power of its products arising from scarcity for substitutes. Acquirer industry would have negative coefficient while target's is expected to have positive.

**Market Value of Equity ( $ME_A$  and  $ME_T$ )** It could be that the size of the merger is affecting the merger outcome as suggested by Dimson and Marsh (1986) and Moeller et al. (2004). Both studies find that large companies tend to perform worse than small and medium companies in stock markets and in mergers respectively. To control for this I include logarithm of the market value of the acquirer and the target 50 days before the announcement date.

**Relative size (S)** measures the size difference between the companies and it is calculated by dividing the size of the acquirer by the size of the target to get their relative size. This variable is expected to have negative coefficient as increasing size of the acquirer is likely to mean larger acquirer bargaining power and consequently smaller target gains.

**International merger (I)** is a dummy variable that gets value of one if the target and acquirer are from different countries, otherwise zero.

## 5 RESULTS

In this chapter I will first present the summary statistics of the sample before proceeding to the main results. The properties of the sample with respect to merger returns are well in line with existing literature with a few minor diffractions. Overall there is little evidence in support of the notion that product market dependencies create bargaining power for either party. Statistically and economically significant relation was found in forward mergers in subsample where both companies have positive returns for RBI and regression coefficients have mostly expected signs. Although findings are generally in contrast with Ahern (2012) it is possible that the lack of evidence is due to too small sample size and noisy data.

### 5.1 SUMMARY STATISTICS

Figure 7 illustrates the distribution of different types of mergers. Horizontal mergers form the single largest group with 45% but vertically related mergers are almost as numerous with 43% share. As a side note of the vertical mergers roughly 40% would have been classified as conglomerate merger if only NAICS had been used for identification. This raises questions about the need to update the results of empirical studies utilizing SIC/NAICS for identifying related or conglomerate mergers.

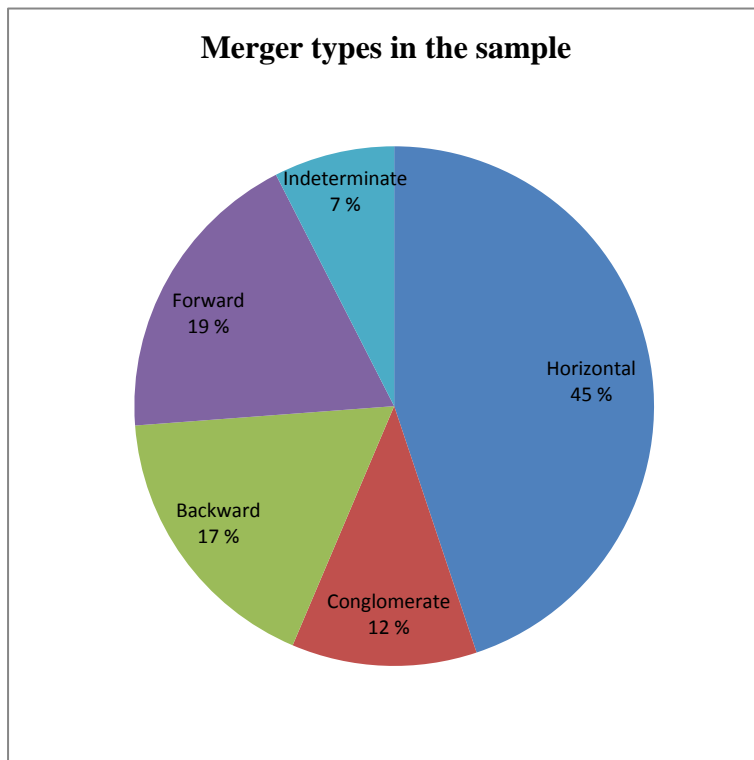


Figure 7: Proportions of different merger types in the sample

Table 2 presents cumulative abnormal returns in which returns of the target and the acquirer are weighted by their market capitalization. As far as I know, no other study has examined returns between different merger types in Europe. From here we learn that average merger increases the value of the merged firm by on average 1.02%. This value is statistically highly

significant with t-value 5.23. In practice this number means that

if we chose a merger at random and invested an equal amount of money to both companies, the expected return to our total investment is 1.02%. When examined by merger type considerable differences start to emerge. Of the major classes of mergers, conglomerate mergers are the most profitable with 1.42% average cumulative abnormal return over the three-day event window and horizontal mergers are the least profitable with only 0.83% return. Closer examination reveals large variation within vertical mergers. Backward mergers actually destroy combined shareholder value on average by -0.54%. This is largely because of losses realized by the acquirers but even the target performance seems worse compared to the acquirers in other types of mergers. Mergers with no ambiguous vertical relationship appear the most profitable type of mergers but the difference to forward mergers is not statistically significant.

**Table 2: Average weighted cumulative abnormal return for each merger**

<i>Panel A: Average of weighted CAR</i>						
Sample	$\mu$ (%)	$\sigma$ (%)	Min (%)	Max (%)	Median	N
All Mergers	1.02	6.11	-50.2	36.80	0.01	798
Horizontal	0.83	6.09	-17.6	36.80	0.31	358
Conglomerate	1.42	5.46	-13.6	24.30	0.88	92
Vertical	0.84	6.46	-50.2	33.30	0.46	348
Backward	-0.54	6.42	-50.2	20.40	0.05	139
Forward	1.31	5.14	-15.5	26.70	0.91	149
Indeterminate	2.82	6.66	-10.6	33.30	1.12	60
<i>Panel B: Average of weighted CAR when both companies have positive returns</i>						
Sample	$\mu$ (%)	$\sigma$ (%)	Min (%)	Max (%)	Median	N
All Mergers	5.42	5.53	0.09	36.8	3.92	264
Horizontal	5.81	5.67	0.19	36.80	4.40	117
Conglomerate	4.67	4.66	0.12	22.90	3.09	29
Vertical	5.22	5.58	0.09	24.40	3.69	118
Backward	5.45	5.66	0.09	24.3	3.92	42
Forward	5.03	5.70	0.46	33.30	3.50	52
Indefinite	5.20	5.37	0.36	24.4	3.39	24

Examination of acquirer CARs and target CARs in Table 3 reveals a familiar pattern in which acquirers' returns are negative or zero while targets' gain. Only the returns of backward mergers are significantly different from zero. Dollar returns of the sample are negative indicating presence of *size effect* [Moeller et al. (2004)] or in other word that there are large deals which bring the total dollar returns of the sample negative. For this reason only looking at the percentage returns is misleading.

**Table 3: Average cumulative abnormal returns of acquirers and targets**

Panel A: Acquirer Cumulative Abnormal Return (CAR)										
Sample	$\mu$ (%)	$\sigma$ (%)	Min (%)	Max (%)	Percentile (%)					N
					10th	25th	50th	75th	90th	
All Mergers	-0.5	8.0	-151.1	29.4	-6.2	-2.6	-0.1	2.5	5.6	798
Horizontal	-0.5	6.1	-25.9	25.6	-7.0	-2.6	-0.3	2.1	5.8	358
Conglomerate	-0.6	4.8	-19.5	14.1	-6.1	-2.9	-0.2	2.1	5.5	92
Vertical	-0.4	10.1	-151.1	29.4	-6.0	-2.5	0.1	2.9	5.3	348
Backward	-1.7	14.3	-151.1	21.8	-9.3	-2.5	-0.1	2.8	5.2	139
Forward	0.3	5.2	-15.8	29.4	-5.5	-2.5	0.2	2.4	4.2	149
Indefinite	1.1	7.0	-17.9	22.5	-8.3	-2.1	0.6	3.4	10.1	60
Panel B: Target Cumulative Abnormal Return (CAR)										
Sample	$\mu$ (%)	$\sigma$ (%)	Min (%)	Max (%)	Percentile (%)					N
					10th	25th	50th	75th	90th	
All Mergers	5.3	12.8	-52.5	102.7	-4.2	-1.0	1.7	8.1	20.6	798
Horizontal	5.1	12.0	-25.1	86.3	-4.2	-0.7	2.1	8.1	18.5	358
Conglomerate	4.8	11.0	-14.0	45.1	-3.0	-0.9	0.9	5.8	19.8	92
Vertical	5.5	14.0	-52.5	102.7	-4.5	-1.1	1.8	8.8	23.1	348
Backward	3.7	12.1	-36.2	69.4	-5.9	-1.4	1.3	5.5	19.2	139
Forward	6.5	14.3	-52.5	67.9	-3.3	-0.8	2.8	9.1	24.9	149
Indefinite	7.4	16.9	-19.4	102.7	-5.6	-0.5	1.9	13.6	25.8	60
Panel C: Acquirer Cumulative Abnormal Return (CAR) when both companies have positive returns										
Sample	$\mu$ (%)	$\sigma$ (%)	Min (%)	Max (%)	Percentile (%)					N
					10th	25th	50th	75th	90th	
All Mergers	4.2	4.5	0.0	29.4	0.4	1.2	2.9	5.3	9.6	264
Horizontal	4.5	4.5	0.0	25.6	0.5	1.1	3.0	6.4	10.5	117
Conglomerate	3.3	3.2	0.1	14.1	0.4	0.7	2.6	4.7	7.2	29
Vertical	4.1	4.7	0.0	29.4	0.4	1.4	2.9	4.7	8.6	118
Backward	4.0	4.1	0.0	21.8	0.3	1.5	3.0	5.1	7.5	42
Forward	4.1	5.3	0.2	29.4	0.5	1.4	2.8	4.1	8.7	52
Indefinite	4.4	4.4	0.3	19.8	0.4	1.2	3.2	6.5	10.3	24
Panel D: Target Cumulative Abnormal Return (CAR) when both companies have positive returns										
Sample	$\mu$ (%)	$\sigma$ (%)	Min (%)	Max (%)	Percentile (%)					N
					10th	25th	50th	75th	90th	
All Mergers	9.6	12.3	0.0	102.7	0.9	1.8	5.3	12.3	25.5	264
Horizontal	8.8	10.1	0.0	56.9	0.9	1.9	5.7	10.3	23.8	117
Conglomerate	9.4	11.3	0.2	45.1	0.3	1.2	3.9	15.6	25.2	29
Vertical	10.5	14.5	0.0	102.7	1.0	1.8	4.6	12.6	31.7	118
Backward	8.2	10.4	0.0	49.2	0.6	1.4	3.7	12.4	23.9	42
Forward	11.5	13.5	0.0	57.8	1.0	2.0	5.5	18.3	34.8	52
Indefinite	12.2	21.4	0.4	102.7	0.8	1.7	3.9	15.1	29.7	24

## 5.2 MAIN RESULTS ON DIVISION OF GAINS

In this section I explore the question do vertical relationships explain division of gains. Before going through the regression results I first examine are there significant differences in division of gains between different merger classes. Since it is likely that agency motives are present in the general sample in addition to the main sample I also examine a subsample where both companies have positive returns. The presence of agency motives is a distorting factor that cannot be easily accounted by any easy proxy variable and thus the positive returns subsample can provide better results. However, selection based on positive returns subjects the sample to potential selection bias which needs to be accounted for. Procedure to do this is proposed and briefly explained.

### 5.2.1 DIVISION OF GAINS IN EUROPEAN MERGERS

Table 4 summarizes the division of gains across the entire sample and the type specific subsamples. From panel A we can see that across all mergers the target gains ( $\Delta\$CAR$ ) on average 1.56 cents per dollar of pre-merger combined equity of the acquirer and target more than the acquirers. Standard deviation of this value is 5.71 and inter-quartile range is 4.49 both of which indicate considerable variation in the measure. The value is statistically and economically significant (t-value of 7.73). In practical terms this means that a randomly chosen merger with combined pre-merger equity value of \$500 million the target would gain on average \$7.8 million more than the acquirer. Column  $\Delta\$CAR \leq 0$  reports the proportion of mergers where the  $\Delta\$CAR$  is less than zero and thus the acquirer gains more than the target. In contrast to notion that targets always capture most of the gains, in 39% of all mergers the acquirers gain more. Figure 9 tells the same story graphically.

The division of gains ( $\Delta\$CAR$ ) appears fairly similar across horizontal, vertical and conglomerate mergers and the differences are statistically insignificant. However, between the backward and forward mergers there appears to be a noticeable difference.  $\Delta\$CAR$  is considerably larger in backward mergers than in forward mergers. This implies that target captures more of the common pie in backward mergers than in forward mergers. These findings are consistent with Ahern. However, unlike Ahern, I find this difference to be

statistically insignificant using Welch's t-test for unequal variances<sup>31</sup> with p-value of 0.13. I believe that the insignificance of the test statistic is due to the smaller sample size in my work. Assuming no change in the mean and standard deviation, the difference would be significant if the sample sizes were roughly twice the size of the ones used.

**Table 4: Summary statistics of the division of gains in mergers**

<i>Panel A: Target gain relative to the acquirer gain (<math>\Delta\\$CAR</math>)</i>											
Sample	$\mu$	$\sigma$	Min	Max	Percentile					$\Delta\$CAR \leq 0$	N
					10th	25th	50th	75th	90th		
All Mergers	1.56	5.71	-25.53	47.29	-3.33	-1.10	0.65	3.39	8.23	39.0 %	798
Horizontal	1.66	5.51	-19.64	27.22	-2.99	-0.92	0.75	3.40	8.00	36.7 %	358
Conglomerate	1.69	4.78	-5.95	26.76	-2.51	-1.14	0.37	3.48	5.88	41.9 %	92
Vertical	1.42	6.13	-25.53	47.29	-3.89	-1.39	0.55	3.28	9.26	40.9 %	348
Backward	1.88	6.46	-8.69	47.29	-3.86	-1.10	0.37	2.99	9.93	39.2 %	139
Forward	1.10	5.58	-25.53	26.66	-3.70	-1.48	0.76	3.34	8.02	40.0 %	149
Indeterminate	1.17	6.68	-22.30	17.05	-6.37	-1.44	0.44	3.78	11.07	49.1 %	60
<i>Panel B: Target's percentage share of total gains when both companies have positive returns (<math>\% \Omega</math>)</i>											
Sample	$\mu$	$\sigma$	Min	Max	Percentile					$\Omega \leq 50\%$	N
					10th	25th	50th	75th	90th		
All Mergers	42.3 %	31.9 %	0.0 %	99.9 %	2.1 %	13.4 %	36.4 %	70.6 %	89.9 %	58.8 %	264
Horizontal	45.7 %	31.9 %	0.0 %	99.9 %	1.3 %	18.3 %	39.7 %	72.3 %	93.2 %	55.0 %	117
Conglomerate	38.7 %	32.0 %	1.0 %	99.1 %	2.1 %	12.6 %	28.5 %	63.5 %	93.0 %	62.8 %	29
Vertical	39.9 %	31.9 %	0.0 %	99.9 %	2.0 %	11.5 %	33.8 %	70.7 %	85.3 %	62.1 %	118
Backward	42.8 %	29.6 %	0.4 %	99.9 %	6.3 %	16.2 %	40.6 %	68.5 %	86.0 %	58.1 %	42
Forward	40.9 %	33.1 %	0.0 %	98.1 %	1.0 %	11.6 %	33.8 %	77.7 %	86.9 %	60.0 %	52
Indefinite	32.8 %	33.2 %	0.1 %	99.9 %	0.9 %	6.2 %	19.3 %	61.3 %	92.5 %	72.0 %	24

Ahern (2012) reports similar results in his study of 4102 mergers in the United States. He finds that in the US mergers targets gain on average 3.5 cents more than the acquirers per each dollar in combined pre-merger market equity. This is roughly twice more than my result. Furthermore, Ahern finds that in comparison to my finding of 39%, in 27% of the mergers acquirers capture larger share of the gains. In unreported t-test and  $\chi^2$  test I find this difference

<sup>31</sup> F-test for unequal variances suggests that the variances are unequal. However, since the sample distribution is skewed and the F-test for equality of variance is known to be susceptible to violations of normality, I also tested the difference of means assuming equal variances. The results are qualitatively unchanged.



between our studies statistically significant. In combination these two differences suggest that

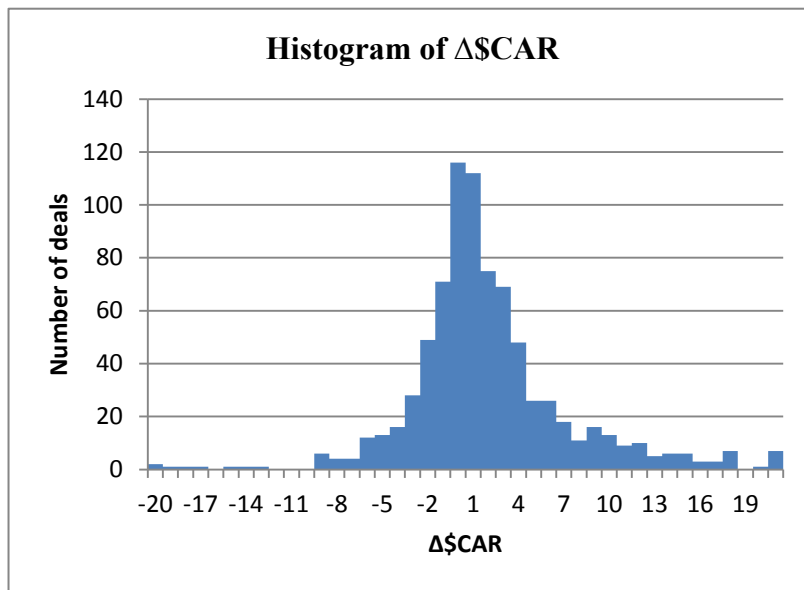


Figure 9: Histogram  $\Delta\$CAR$  of in all mergers

in the US targets seem to be able to command greater bargaining power in negotiations. This notion is supported by greater observed the target CAR in Ahern's study in comparison to mine: around 20% vs. 5% though I cannot for sure is this inter-study difference

statistically significant.

Panel B of Table 4 displays the summary statistics for the division of gains when both the target and acquirer have positive returns. In this context measuring the target's share as a fraction of total gains is sensible and now the results are displayed as target's fraction of total gains. The most interesting finding is that when both companies observe positive returns acquirers capture on average more of the value created in all merger types leaving the average

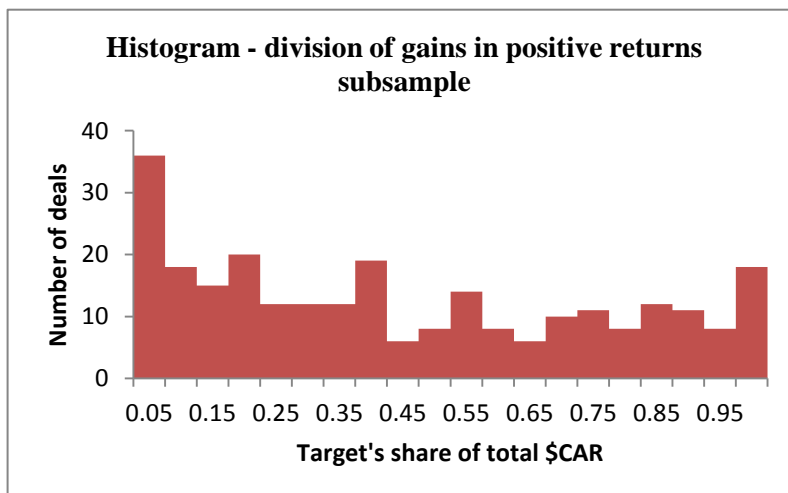


Figure 8: Histogram of target's share of gains when both companies have positive returns

target with only 42.3% of the gains. This finding is very much at odds with the notion that the target nearly always gains more than the acquirer. Column " $\Omega \leq 50\%$ " indicates the fraction of mergers where the acquirer captures 50% or more of the gains. Acquirer

gains more than 50% of the total gains in 58.8% of the mergers ( $\Omega \leq 50\%$ ). These points are also demonstrated in Figure 8 which shows the distribution of target's share of total  $\$CAR$ . Large fraction of the transactions appear below the 50% fraction indicating that in

most cases acquirer captures more than 50%. The distribution appears vaguely uniform with the exception of the first bin (<5%). The peak in the first bin means that in many deals the target captures less than 5% of the total gains. This is primarily driven by a considerable number of mergers where the target is small compared to the acquirer and their dollar gains are consequently small. For this reason it is very dangerous to compare division of gains using percentage returns.

So far my results suggest that there are statistically significant differences between mergers and division of gains between the US and Europe suggesting that further research into the differences is warranted to establish do these differences withstand greater scrutiny.

### 5.2.2 EXTENT OF VERTICAL RELATIONS IN EUROPEAN MERGERS

Table 5 describes the statistical measures of customer-supplier relation variables for the vertical mergers subsample. In the backward mergers average customer/acquirer buys 6.4% of the supplier's/target's output (RBI). These purchases represent about 3.9% of the average customer's/acquirer's input costs (RSI). Both of these figures are very large and economically substantial.

Contrast these finding with Ahern whose corresponding values are 4.3% (RBI) and 3.5% (RSI). While his RSI value is not significantly different from mine, in untabulated t-test I find that his RBI value is significantly lower than mine different at 5% significance value. Although this finding appears interesting I am rather skeptical whether this represents true difference between the US and European mergers. As I explained in before the sample suffers from unexpectedly large decay. It is possible that my sample is biased to favor large mergers over smaller ones. If companies that have above average RBI also tend to be larger, such as chemical and petroleum industries, then the average of my sample should also be higher, even if there is no difference between the true population means.

In forward mergers the average customer/target buys 4.9% of the average supplier/acquirer's output (RBI) and these purchases represent on average 3.9% of the average supplier/acquirer's input costs (RSI). As with backward mergers, Ahern reports significantly lower value for RBI (2.48%). This difference is significant at 5% level.

**Table 5: Summary statistics of the customer-supplier relations in vertical mergers**

Backward Mergers					Percentile (%)					N
	$\mu$ (%)	$\sigma$ (%)	Min (%)	Max (%)	10th	25th	50th	75th	90th	
RBI (%)	6.42	13.58	0.01	93.30	0.04	0.17	1.07	6.91	19.67	139
RSI (%)	3.89	8.85	0.01	69.83	0.08	0.32	1.37	3.60	8.19	139
RBI/RSI	2.81	6.05	0.01	44.36	0.18	0.34	1.00	2.13	6.48	139
Forward Mergers										
RBI (%)	4.92	15.19	0.01	149.39	0.02	0.11	0.47	3.12	11.95	149
RSI (%)	3.86	11.99	0.01	70.16	0.08	0.48	0.94	2.02	6.41	149
RBI/RSI	2.46	7.07	0.01	51.14	0.09	0.25	0.752	1.62	4.25	149
Indefinite Vertical Mergers										
RBI (%)	5.59	10.85	0.01	32.74	0.091	0.178	0.64	2.93	32.74	60
RSI (%)	2.52	6.13	0.03	34.25	0.081	0.255	0.76	2.61	3.49	60
RBI/RSI	2.97	4.53	0.04	27.00	0.10	0.47	1.01	3.23	9.38	60

While the numbers presented above can appear small as such, it is important to keep in mind that these numbers reflect the share of costs among all factors of production along with employment costs and taxes. And consequently their actual share of raw material costs is therefore considerably higher than the reported figure. Fan and Goyal (2006) suggest that 1% RSI threshold is sufficient in identifying significant vertical relationship. Both RSI and RBI distributions are highly skewed to right as seen in the median values well below the average values.

Unlike Ahern, I also calculated RBI and RSI for indefinite vertical mergers. The indefinite class is those mergers that are not horizontal mergers and have vertical relationship but the direction of the relationship cannot be deduced from the RBI and RSI values. In his study, Ahern simply dumped those mergers into residual category and did not analyze them. Casual observation of these mergers suggests that most of those companies are in the IT field, financial services or in oil and gas industries. While there might not be unambiguous customer-supplier relationship, it is certain that these companies do have significant trading relationship as suggested by comparing the values between different types of mergers.

In addition to RBI and RSI I also calculated RBI/RSI ratio for each transaction. If vertical mergers were primarily driven by asymmetry in customer-supplier relations, we should see

corresponding patterns in RBI/RSI ratio. However, as is evident from the summary statistics, no such differences exist among different types of mergers and each merger has a very broad spread of the variable.

### 5.2.3 THE DETERMINANTS OF DIVISION OF GAINS

Table 6 and Table 7 report the results of the first regression run on RBI and RSI in explaining division of gains in backward and forward mergers. The sample is divided into two separate regressions because backward and forward mergers are expected to have opposite signs of the coefficients of RBI and RSI. The sample size is smaller than the reported in the previous tables due to data limitations, in particular missing concentration ratios and one or more of the variables needed to calculate the price cost margin. The dependent variable is  $\Delta\$CAR$  which is the target's relative percentage gain to acquirer's gain standardized by the joint market value of both companies 50 days prior the merger.

The table's first column indicates the expected sign of the independent variable's coefficient; the second column is for the first regression that only includes the variables that reflect the firm scarcity. The second column adds some additional control variables such if the merger was international, logarithmic sizes of the companies and the acquirer's relative size to target.

Quality control measures undertaken are following. All the regression results are checked for heteroskedasticity and the significance tests are performed using heteroskedasticity-consistent standard errors. Initially I included fixed effects for target and acquirer industry, year and target and acquirer country. However, due to the small sample size I run out of degrees of freedom if all the fixed effects are included which is in total nearly 100 variables to be included. Partial inclusion of some fixed effects does not materially improve the model and are for this reason left out.

#### 5.2.3.1 BACKWARD MERGERS SAMPLE

I will first present the results for backward mergers sample. As visible from Table 6 the expected signs of the coefficients for RBI and RSI are as expected. However, the actual coefficients are highly insignificant which is in contrast with Ahern (2012) who found statistically significant relation. From other variables, only the acquirer M/B ratio has statistically significant coefficient at the 5% significance level. Also the intercept of the first regression was significant at 10% significance level. This would suggest that to some extent the division of gains by default is not equal.

**Table 6: Target's gain relative to acquirer gain in backward vertical merger**

<b>Backward mergers</b>		Regression	
<b>Variable</b>	<b>Expected sign</b>	<b>1</b>	<b>2</b>
Intercept	N/A	4.574* [0.089]	12.283 [0.135]
RSI	+	0.024 [0.813]	0.08 [0.936]
RBI	-	-0.035 [0.51]	-0.024 [0.68]
Acquirer M/B	?	0.051** [0.032]	0.055** [0.026]
Target M/B	?	-0.052 [0.723]	-0.035 [0.817]
Acquirer price-cost margin	-	-0.008 [0.179]	-0.007 [0.249]
Target price-cost margin	+	0.000 [0.748]	0.000 [0.572]
Acquirer industry profit	-	-0.56 [0.457]	-0.061 [0.437]
Target industry profit	+	-0.17 [0.772]	-0.014 [0.822]
Acquirer industry concentration	-	-0.001 [0.972]	0 [0.993]
Target industry concentration	+	-0.023 [0.58]	-0.018 [0.679]
International merger	?	N/A	-0.853 [0.617]
Relative size of merger	+	N/A	0.041 [0.633]
Natural logarithm of acquirer market equity	-	N/A	-0.318 [0.360]
Natural logarithm of target market equity	+	N/A	-0.052 [0.917]
Acquirer industry fixed effects		No	No
Target industry fixed effects		No	No
Acquirer nation fixed effect		No	No
Target nation fixed effects		No	No
Year fixed effects		No	No
R <sup>2</sup>		0.1	0.128
Adjusted R <sup>2</sup>		-0.007	-0.025
Number of observations		93	93

Ahern also reported significant coefficients for acquirer's and target's price-cost margins. I fail to find significant or even near significant relationship for these variables. While I suspect that the small sample size is to blame for most of the differences between my and Ahern's studies, I cannot entirely rule out the possibility that using the US concentration ratios in place of European concentration ratios is not necessary a very good proxy despite the previous literature suggesting otherwise.

### **5.2.3.2 FORWARD MERGERS SAMPLE**

Table 7 presents the regression results in the forward mergers subsample. As is the case with the backward sample, none of the variables describing product market relationship (RBI and RSI) are statistically significant. The coefficients of the variables of interest have the expected signs and their magnitude is in the same ballpark with Ahern's findings. However, despite the coefficients lacking statistical significance, they have much lower p-values than in the backwards merger sample. Ahern found similar trend in his study where coefficients for RBI and RSI in forward mergers sample were statistically significant and stronger than in backward mergers where they were statistically insignificant. This could imply that my sample size is too small to give statistical significance to my findings.

From other variables in the forward merger sample, the only statistically significant variable is the target's M/B ratio which is significant at even at 0.5% and 1% significance level. This is inconsistent with Ahern who failed to find any relationship with target's M/B and division of gains. However, he did find coefficient for acquirer's M/B statistically very significant. It is not immediately clear what could be the reason for this difference between our studies. Ahern also find acquirer industry concentration and acquirer industry profitability significant both of which I failed to find significant.

If the RSI and RBI coefficients had been significant, the result would be economically very significant. One standard deviation increase in RSI in forward mergers would mean 6.5%-point decrease in target's share of gains. This is not a trivial amount, however, one should bear in mind that 90% of the forward mergers the target has RSI lower than 6.41% which limits the applicability of this result in the real world.

**Table 7: Target's gain relative to acquirer's gain in forward vertical mergers**

<b>Forward mergers</b>			
<b>Variable</b>	<b>Expected sign</b>	<b>Regression</b>	
		<b>1</b>	<b>2</b>
Intercept	N/A	3.289 [0.279]	-6.813 [0.46]
RSI	-	-0.561 [0.296]	-0.557 [0.301]
RBI	+	0.114 [0.554]	0.08 [0.688]
Acquirer M/B	?	0.004 [0.467]	0.004 [0.527]
Target M/B	?	-0.499*** [0.004]	-0.468*** [0.006]
Acquirer price-cost margin	-	0.000 [0.974]	0.000 [0.973]
Target price-cost margin	+	0.000 [0.869]	0.000 [0.833]
Acquirer industry profit	-	-0.012 [0.837]	0.016 [0.792]
Target industry profit	+	-0.92 [0.284]	-0.08 [0.364]
Acquirer industry concentration	-	-0.006 [0.868]	-0.007 [0.857]
Target industry concentration	+	0.05 [0.284]	0.036 [0.485]
International merger	?	N/A	1.055 [0.578]
Relative size of merger	+	N/A	0.036 [0.12]
Natural logarithm of acquirer market equity	-	N/A	-0.104 [0.809]
Natural logarithm of target market equity	+	N/A	0.58 [0.156]
Acquirer industry fixed effects		No	No
Target industry fixed effects		No	No
Acquirer nation fixed effect		No	No
Target nation fixed effects		No	No
Year fixed effects		No	No
R <sup>2</sup>		0.195	0.287
Adjusted R <sup>2</sup>		0.069	0.106
Number of observations		105	105

### **5.2.3.3 SUMMARY OF THE FIRST REGRESSIONS**

These first two set of tests do not provide strong evidence in support of the hypothesis that the product market relationships affect bargaining outcomes. Only evidence in support for the idea is that the signs of the coefficients of the variables of interest are as expected. Also differences in the significance of the coefficients between the two regressions which mirror the results of Ahern suggest that too small sample size could explain why results are not statistically significant. Although the results are not particularly encouraging presence of omitted variables such as agency motives or hubris could affect the results. Next I present the results of regressions run on the subsample where both the target and the acquirer have positive returns which should alleviate the concerns of unobserved agency issues.

### **5.2.4 THE DIVISION OF GAINS WHEN BOTH COMPANIES HAVE POSITIVE RESULTS**

The dependent variable ( $\Delta\$CAR$ ) used in previous regressions is not intuitively understandable as a measure of division of gains. A much more intuitive approach is to think of the total gains as a pie to be split between the two parties but this line of thinking works only when both companies have positive returns. In this subsample that is exactly the case and I use target's share of the total gains ( $\Omega\%$ ) as dependent variable for the regressions.

Assuming rational and efficient markets, mergers with positive returns to both companies are less likely to be motivated by agency motives than mergers where either party has negative returns. Presence of agency motive would constitute omitted variable bias which would bias the estimates for the coefficients. However, despite these benefits the procedure can potentially introduce sampling bias which means that the standard OLS coefficient estimates could be biased. This issue is addressed explicitly in Section 5.2.4.3.

#### **5.2.4.1 BACKWARD MERGERS WITH JOINTLY POSITIVE RETURNS SUBSAMPLE**

Table 8 presents the results for the regression for positive returns subsample in backward mergers. For making it possible to compare coefficients between the main sample and positive returns subsample I also run the regression using  $\Delta\$CAR$  as dependent variable. Results of both regressions are presented side-by-side. Like Ahern I do not find RSI or RBI statistically significant in case of backward mergers when using target's share of gains as the dependent variable. Curiously the signs of the coefficients are as expected but that could have easily arisen by chance. Of the control variables only the logarithmic size of the acquirer is significant.



The case with  $\Delta\$CAR$  is more interesting. As was the case with the backward mergers main sample, neither RSI nor RBI is statistically significant although the p-values have improved. Only statistically significant variables were target industry profitability, acquirer price cost margin and the logarithmic size of the acquirer's market equity. The significance of these variables can be explained in the following ways. The greater the target industry's profit margin, the greater is the target's share. This is consistent with the notion that industries with barriers to entry incentivize the acquirers to enter the industry via merger rather than by starting up a company. This gives the targets leverage in the merger negotiations and improves their bargaining outcomes. Greater acquirer price cost margin reflects the scarcity of the acquirer's assets. The higher the price cost margin the scarcer the assets be they knowhow, brand or efficiency and this scarcity gives bargaining power to the acquirer. Explaining the acquirer size coefficient is more difficult. It appears that greater the acquirer, the less the target benefits. Size difference does not seem to explain this as the coefficient for the relative size is insignificant and small. In other words greater size of acquirer seems to benefit the acquirer irrespective of the size difference but whether this actually happening or arises because of the way regression equation is specified, I cannot say.

**Table 8: Target's gain in the backward mergers subsample where both companies have positive returns**

<b>Backward mergers</b>		Regression			
<b>Variable</b>	<b>Expected sign</b>	Fraction 1 ( $\Omega$ )	Fraction 2 ( $\Omega$ )	$\Delta\text{\$CAR}$ (1)	$\Delta\text{\$CAR}$ (2)
Intercept	N/A	48.825 [0.000] t=6.817	134.033 [0.108]	1.172 [0.523]	40.195*** [0.003]
RSI	+	0.252 [0.628]	0.199 [0.733]	0.073 [0.512]	0.070 [0.415]
RBI	-	-0.606 [0.215]	-0.229 [0.697]	-0.108 [0.302]	-0.104 [0.241]
Acquirer M/B	?	1.109 [0.351]	0.421 [0.786]	0.080 [0.709]	-0.341 [0.147]
Target M/B	?	-1.009 [1.589]	-0.806 [0.698]	-0.171 [0.560]	0.303 [0.325]
Acquirer price-cost margin	-	N/A	-0.410 [0.410]	N/A	-0.158** [0.041]
Target price-cost margin	+	N/A	0.000 [0.968]	N/A	0.000 [0.373]
Acquirer industry profit	-	N/A	-0.960 [0.291]	N/A	-0.216 [0.113]
Target industry profit	+	N/A	0.980 [0.202]	N/A	0.262** [0.028]
Acquirer industry concentration	-	N/A	0.046 [0.923]	N/A	-0.107 [0.138]
Target industry concentration	+	N/A	-0.269 [0.443]	N/A	-0.038 [0.461]
International merger	?	N/A	-4.872 [0.723]	N/A	-2.042 [0.317]
Relative size of merger	+	N/A	0.161 [0.447]	N/A	0.053 [0.638]
Natural logarithm of acquirer market equity	-	N/A	-11.588** [0.025]	N/A	-2.071*** [0.008]
Natural logarithm of target market equity	+	N/A	8.670 [0.126]	N/A	0.592 [0.459]
Acquirer industry fixed effects		No	No	No	No
Target industry fixed effects		No	No	No	No
Acquirer nation fixed effect		No	No	No	No
Target nation fixed effects		No	No	No	No
Year fixed effects		No	No	No	No
R <sup>2</sup>		0.102	0.579	0.120	0.734
Adjusted R <sup>2</sup>		-0.054	0.187	-0.033	0.487
Number of observations		42	31	42	31

#### **5.2.4.2 FORWARD MERGERS WITH JOINTLY POSITIVE RETURNS SUBSAMPLE**

Table 9 presents the regression results for positive returns subsample in forward mergers. What is interesting with the results is that the first time one of the product relationship variables is statistically significant. In the first and more limited regression RBI is statistically significant at 5% significance level and furthermore, the coefficient is also economically significant suggesting that 1% increase in RBI translates into almost 1.8%-point increase in acquirer's share of the joint gains. Or put in a slightly different way, one standard deviation increase in RBI means almost 27%-point increase in the acquirer's share. Of course this extrapolation is overt simplification but it serves to highlight the economics magnitude of the result. Despite the statistical significance it is worthwhile to point out that the significance of the result disappears (although the RBI coefficient is virtually unchanged) when additional variables are introduced to the regression undermining the credibility of the finding. The p-value is also just barely below the 5% rejection threshold so it is not implausible that the result arises by to random chance. Like in the general sample, the significance of the regression coefficients appears to be bigger in forward mergers than in the backward mergers which is consistent with Ahern.

Although the RBI is significant, the same cannot be said about RSI which in this first regression has unexpected coefficient. In the more extensive follow-up regression the sign corrects itself but the coefficients remain statistically insignificant. None of the control variables are significant at 5% level. Regressions run using  $\Delta\$CAR$  as dependent variable fail to have significant results either with the exception of target M/B ratio which contrary to signaling scarcity and thus increased bargaining power seems to reduce target's share. However, like mentioned previously, M/B has multiple interpretations and thus it is not very surprising to see unexpected sign for the coefficient.

In his study Ahern finds that RSI and RBI are indeed statistically and economically significant in forward mergers. However, Ahern's sample size for this subsample is considerably bigger than mine which could explain why I fail to find similar results.

**Table 9: Target's gain in the forward mergers subsample where both companies have positive returns**

<b>Forward mergers</b>		Regression			
<b>Variable</b>	<b>Expected sign</b>	<b>Fraction 1 (<math>\Omega</math>)</b>	<b>Fraction 2 (<math>\Omega</math>)</b>	<b><math>\Delta\text{\\$CAR}</math> (1)</b>	<b><math>\Delta\text{\\$CAR}</math> (2)</b>
Intercept	N/A	34.086*** [0.001]	61.07 [0.436]	1.477 [0.246]	-11.021 [0.382]
RSI	-	1.109 [0.796]	-1.346 [0.523]	-0.390 [0.523]	-1.580 [0.175]
RBI	+	1.766** [0.049]	1.499 [0.164]	0.169 [0.174]	0.151* [0.09]
Acquirer M/B	?	0.086 [0.282]	0.119 [0.221]	-0.008 [0.472]	-0.006 [0.647]
Target M/B	?	-0.707 [0.480]	-0.314 [0.809]	-0.756*** [0.000] t=-5.407	-0.631*** [0.004]
Acquirer price-cost margin	-	N/A	0.033 [0.674]	N/A	-0.001 [0.897]
Target price-cost margin	+	N/A	-0.011 [0.266]	N/A	0.000 [0.988]
Acquirer industry profit	-	N/A	-0.082 [0.902]	N/A	0.094 [0.323]
Target industry profit	+	N/A	-0.882 [0.324]	N/A	-0.152 [0.231]
Acquirer industry concentration	-	N/A	-0.145 [0.689]	N/A	0.050 [0.317]
Target industry concentration	+	N/A	0.071 [0.894]	N/A	0.107 [0.172]
International merger	?	N/A	-3.688 [0.833]	N/A	0.041 [0.987]
Relative size of merger	+	N/A	0.159 [0.732]	N/A	0.034 [0.531]
Natural logarithm of acquirer market equity	-	N/A	-6.202 [0.146]	N/A	-0.458 [0.440]
Natural logarithm of target market equity	+	N/A	5.963* [0.064]	N/A	0.509 [0.251]
Acquirer industry fixed effects		No	No	No	No
Target industry fixed effects		No	No	No	No
Acquirer nation fixed effect		No	No	No	No
Target nation fixed effects		No	No	No	No
Year fixed effects		No	No	No	No
R <sup>2</sup>		0.291	0.563	0.574	0.734
Adjusted R <sup>2</sup>		0.177	0.155	0.506	0.485
Number of observations		52	39	52	39

### **5.2.4.3 *POTENTIAL SELECTION BIAS AND ADDRESSING IT***

As implied before, choosing only mergers where both parties experience positive returns may cause standard OLS regression estimates to be biased. Luckily, there is a way to estimate if the bias is significant and then correct for it using Heckman (1979) two-stage selection models if the normality assumption can be satisfied. In practice it is to implement and has strong basis in statistical theory. The following description of the method is largely from Ahern.

The correction is implemented by first running a probit regression that estimates the probability of being included in the positive returns subsample conditional being backward or forward merger. Fitted values of the first stage estimation are transformed into inverse Mills ratio variable,  $\lambda$ , which is included in the second-stage estimation to control for the probability of entering the sample. To identify the selection effect in the second-stage regression there must be a set of excluded variables in the first-stage which explain variation in the probability that both the target and the acquirer have positive returns while not affecting the coefficients of interest through their absence in the second-stage. Ahern uses form of payment, target defenses, relative value and firm sizes to estimate the probability of being included in the sample and these variables are consequently dropped in the second stage.

As I did not find significant results that should be tested for robustness, I do not perform the Heckman correction as it would be unlikely to improve the results. However, I do recognize that should my study be replicated with a larger sample, the self-selection bias discussed in this subsection should be addressed, especially if significant results are found in the OLS regression.

## **5.3 SUMMARY OF THE RESULTS AND SUGGESTIONS FOR FURTHER RESEARCH**

In this study I find no conclusive evidence that vertical relations affect division of gains between targets and acquirers. However, there are some clues of which implications are consistent with Ahern's findings suggesting that a revision of this study with larger and better quality sample in the future might be worthwhile. Although most results are not statistically significant coefficients for forward mergers have higher statistical significance than those for backward mergers. This is in line with Ahern who finds no significant relationship between product market relations and division of gains in backward mergers but finds relationship in forward mergers. This result is not predicted by transaction cost economics (Section 2.2.2.2.1) in which the ultimate owner is irrelevant or by any theoretical models of vertical integration

based on acquisition of market power (Section 2.2.1.1.2). The property rights theory predicts which party should be the acquirer but it does not make the prediction on the intensity of product market relationships. Furthermore, it does not explain why those relations should matter only in forward mergers. That question is left for future research.

An interesting extension to my study would be to investigate if the relations are changed if we impose minimum values for the RSI and RBI. In this study no such limitations were imposed as long as the direction of the merger could be ambiguously determined from the relative values of RSI and RBI. Setting a minimum value might select mergers that where the vertical relationship is more important in the motivation for the merger.

## 6 CONCLUSIONS

In this thesis I empirically investigate the impact of industrial level product market relations to bargaining outcomes in vertical merger negotiations following the example of Ahern (2012). Unlike Ahern, who conducted his study in the United States, I focus on the European mergers.

The research problem is addressed by identifying vertical mergers using Input-Output tables and calculating relative buyer importance (RBI) and relative supplier importance (RSI) scores which also proxy the supplier's dependence on the buyer and buyer's dependence on the supplier as measured by the industry level trade between the industries of the merging companies. Bargaining outcomes are measured by comparing the difference in cumulative abnormal dollar returns of the merging companies standardized by the company size and they are used as the dependent variable in an OLS regression in which RBI and RSI are used as the main variables of interest to explain the variation in bargaining outcomes. In process of identifying backward and forward mergers, as a byproduct, I also identify horizontal and conglomerate mergers and provide a new insight into the fraction of different types of mergers in the Western Europe in the past 20 years.

Contrary to previous literature my study fails to find solid evidence in support of the notion that product market relations affect division of merger gains. However, as my sample size is considerably smaller than used in studies before there is plausible chance that failure to find significant results is due to sample size. The fact that significance of my coefficients are higher in same subsamples where previous studies find significant results corroborates with this idea. Furthermore, I find that the common notion that target nearly always captures lion's share of the common gains is false. In approximately 40% of the mergers the acquirers capture greater share of the dollar gains and in a subsample where both companies have positive returns this figure is 60%. Finally my work on the classification of the sample mergers shows that vertical mergers are more common than previously anticipated constituting about 40% of all the mergers. Conglomerate mergers are consequently rarer as merger classification on SIC/NAICS falsely classifies some of the vertical mergers as conglomerate mergers.

## 7 APPENDICES

This section contains the Appendices.

### 7.1 APPENDIX A – SAMPLE DECAY

During this study I encountered an unexpected problem: despite my best efforts to beforehand estimate data availability in assessing the feasibility of this study in the end I was not able to get all the data I wanted as would have sunk my sample even below theoretical minimum for regression analysis. The sample size is in my view too low to draw strong conclusions from the results but as the true state of affairs was revealed only after too much effort was already invested into the study I decided to carry on with it anyway. After all, the goal of a Master's Thesis is to demonstrate the understanding and use of scientific methods and reporting rather than producing new knowledge.

Initial restrictions on my sample yielded 4724 observations from SDC for year 1984 onwards. After applying time restrictions (i.e. excluding deals prior 1.1.1990), checking that the names match and availability of market data that number shrunk to 3549 observations. At this point I estimated that after all unforeseen reductions my data sample would be no less than 3000 observations. As it turned out, this estimate turned out to be wrong by large margin. In the end I would have only about 800 observations for my final sample.

As I was warned beforehand about availability of market data, I focused my assessment of the potential sample size based on the number of daily returns available. Since retrieving all the necessary data on all data variables would have required considerable time, I retrieved only the most scarce data classes for inspection. In practice this meant that I downloaded the daily returns for the event day for all companies and assumed that if that data was present then all other market data and accounting information would be available too. This turned out to be a very wrong assumption as initially I did not properly check for the data quality.

When I actually downloaded all the data and started processing it, I had to discard far more observations than I had anticipated. The biggest reason was that a large number of the cells had no data recorded in them but the program returned series of zeros in them rather than leaving the cell blank or giving an error message. When I was initially checking for the data availability I counted the number of valid observations using “=count” function in Excel which counts the number of cells with have a numeric value in them. For this reason Excel had also counted observations with value zero while in reality those should not have been



counted. To make things worse, also a number of companies were missing either market value data (even if the event window returns were available correctly) or one of the accounting values used to count some of the control variables. Finally, combination of different data bases then further reduced some observations as market concentration data was not available for all industries.

While I had taken into consideration that for a valid observation daily returns are required for both the acquirer and target, I had not checked the availability of all 15 other variables that were required for the study. A missing value even in one of the variables would mean that the entire observation had to be discarded in the regression phase. This turned out to be particularly crucial as many of the discarded observations had only one or two missing in one of the non-market raw variables (e.g. sales or book value of equity). As a result I ended up with only a quarter of the observations that I had anticipated at the beginning of the study.

## **7.2 APPENDIX B – MORE INFORMATION ON MAKE AND USE TABLES**

The Make table has three relevant columns: the first one indicates the producing industry and it is identified by a unique 6-digit I/O industry code, the next column identifies a commodity that the industry indicated in the first column is producing. Analogously the commodity is identified by a 6-digit I/O commodity code. The last column indicates the monetary value of the commodity produced by the industry indicated in the first column. This is effectively the amount of money that the producer receives for selling the output. It is important to realize that any industry can produce more than one type of commodity, for example “cement manufacturing” industry produces not only cement but among other things also “stone mining and quarry products”, “lime and gypsum products” and “sand, gravel, clay, and ceramic and refractory minerals”.

The Use table on the other hand lists where the goods produced in the Make table are going. Besides the commodity codes listed in the Make table, the Use table has provisional codes for imports and exports, scrap and second hand goods and three special accounting provisions, namely employee compensation, taxes and gross margin. The structure of the Use table is somewhat different from the Make table. The first column indicates the commodity or item that is being used by the industry in indicated in the second column. The third column shows the monetary value of the use of that good or item from the producer’s perspective – not the user’s. In other words the value indicated in the third column is what the producer was paid for it – not what the user paid for it. The following columns indicate all sorts of other

costs that the purchaser had to pay to get the commodity to its premises. These costs include various transportation costs and sales margins taken by middlemen. The last column is the sum of the producer price and all the intermediate costs and indicates the value that the user paid for the commodity in total.

### **7.3 APPENDIX C – LIST OF STOCK MARKET INDICES USED IN ESTIMATION OF THE REGRESSION COEFFICIENTS OF NORMAL RETURNS**

In this appendix are listed all the benchmark indices that were used in estimation of the normal returns coefficients and the normal returns. As a general rule, the main overall stock market index from each country was included if it was available in Thomson DataStream. If that was not possible then an alternative index was used provided that in the description of the index it was stated that it seeks to track overall market movements within its country. For the names of the indices, see the table below. Note that there is no index for Luxembourg because the final sample does not contain any observations from there.

**Table 10: List of indexes used in assessing the normal returns**

<b>Country</b>	<b>Name of the Index</b>
Austria	ATX (Austrian Traded Index)
Belgium	Belgium 20
Denmark	OMX Copenhagen
Finland	OMX Helsinki
France	SBF 120
Germany	MDAX Frankfurt
Greece	Athex Composite
Ireland	Ireland Stock Exchange Overall (ISEQ)
Italy	FTSE Italy
Netherlands	AEX All Share
Norway	Oslo Exchange All Share
Portugal	Portugal PSI General
Spain	Madrid Stock Exchange General (IGBM)
Sweden	OMX Stockholm
Switzerland	Swiss Market (SMI)
United Kingdom	FTSE All Share

## 7.4 APPENDIX D – EQUATIONS USED IN THE SIGNIFICANCE TESTING

t-test for significance for one day abnormal returns

$$t(N-1) \sim \frac{\overline{AR}_t}{\hat{\sigma}_{\overline{AR}_t}}$$

where

$$\hat{\sigma}_{\overline{AR}_t} = \frac{1}{T-1} \sqrt{\sum_{t=-250}^{-51} (\overline{AR}_t - \overline{\overline{AR}})^2}$$

where T=number of trading days in control period

t-test for significance of three-day CAR:

$$t(N-1) \sim \frac{CAR_{t-1,t_1}}{\sqrt{3} \times \hat{\sigma}_{\overline{AR}_t}}$$

t-test for difference between CARs of subsamples x and y for period T

$$DCAR_{x,y} = \sum_{t=-1}^1 (\overline{AR}_{xt} - \overline{AR}_{yt})$$

$$t(N_x + N_y - 2) \sim \frac{DCAR_{x,y}}{\sqrt{T} \times \hat{\sigma} \times \sqrt{\frac{1}{N_x} + \frac{1}{N_y}}}$$

where

$$\hat{\sigma} = \sqrt{\frac{\hat{\sigma}_{AR_{xt}}^2 \times (N_x - 1) + \hat{\sigma}_{AR_{yt}}^2 \times (N_y - 1)}{N_x + N_y - 2}}$$

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